Glenn (Jas)

THE

MYSTERIES OF NATURE

REVEALED,

OR THE

IDENTITY OF LIGHT, HEAT AND ELECTRICITY

FULLY ESTABLISHED,

EMBRACING A VARIETY OF NEW AND ORIGINAL SUBJECTS OF GREAT PRACTICAL UTILITY.

BY JAMES GLENN,

AUTHOR OF "THE REAL NATURE OF THE ELECTRIC FLUID," &c.; MEMBER OF THE NATIONAL INSTITUTE, WASHINGTON.

NEW YORK:

PRINTED AT THE HERALD JOB OFFICE, 97 NASSAU STREET.

1846.

THE

MYSTERIES OF NATURE

REVEALED,

OR THE

IDENTITY OF LIGHT, HEAT AND ELECTRICITY

FULLY ESTABLISHED,

EMBRACING A VARIETY OF NEW AND ORIGINAL SUBJECTS OF GREAT PRACTICAL UTILITY.

BY JAMES GLENN,

AUTHOR OF "THE REAL NATURE OF THE ELECTRIC FLUID," &c.; MEMBER OF THE NATIONAL INSTITUTE, WASHINGTON.

NEW YORK:

PRINTED AT THE HERALD JOB OFFICE, 97 NASSAU STREET.

1846.

TO JOHN GLENN.

My Dear Son,

I have thought proper to dedicate this little treatise to you, as a mark of my regard, and affection—and I have no doubt that you will receive it as such, and that you may possibly think of it, and read it, long after the person who writes it has ceased to exist. It is under these impressions that I accompany it with a short advice, which, I trust, may have a beneficial effect on your conduct You are now on the verge of manhood, and any bad habits or erroneous opinions you may form, will require a great effort of the mind to efface them afterwards ; the necessity therefore, is obvious, that you should acquire those that are useful and beneficial. There is nothing that I can recommend more deserving of your attention, and better calculated to have an excellent influence on your character than the study of the natural sciences—such as Chemistry, Botany, Natural Philosophy, Materiæ Medica, and Natural History. It may not be in your power to make yourself master of many or even any of them, but if you acquire a taste for reading such subjects, you will soon become conversant with the most of them. The delight afforded in the pursuit of these studies, may be the means of saving you from a great many youthful vices and indiscretions, into which so many young men are so liable to plunge themselves. It is said " an undevout Philosopher is mad," and I may add " a vicious philosopher is mad," for I have never known one of an immoral character, and indeed their occupations are so delightful, and their sources of amusement and instruction so numerous, that they never have a tedious hour, and their whole life seems to be a round of enjoyment. I have not included Astronomy in the above list of subjects, because I think it of no practical utility, and the greater part of it consists of mere vagaries of the imagination. It is, therefore, of no consequence to you or any body else, whether there is a volcano in the moon, or a man in the moon ; the one idea is just as plausible as the other, and the latter has the merit of being the most natural. They can never arrive at any certainty with the most of their suppositions, and we have seen Astronomers that had studied the science for half a lifetime, completely nonplussed by the argument of a simple clown. To acquire the knowledge of such a science is not worth a tenth part of the time spent in obtaining it ; even although you were willing and could afford the expense ; and it is only fit for indolent shepherds and idle gentlemen. I do not mean to insinuate that you should follow any of the pursuits mentioned, to the neglect of your calling or your profession in life, or even to the exclusion of other accomplishments ; but I would rather see you moral and intelligent, than to see you possessed of the wealth of an Astor, without these qualifications. If you enjoy your health, you may become both wealthy and intelligent—but recollect the word " health," for the possession of it is the first of blessings, and without it, you cannot enjoy any thing—even although you had the riches of Mexico and Peru—never, therefore, put it in jeopardy on any occasion. It is a pleasing sight to see a virtuous, promising young man or woman—but a youth degraded by intemperance and other vices, is a loathsome, pitiable object, and I have seen so many of them in this city, in the lowest state of debasement, that to give you a just estimate of their appearance, the English language does not furnish me with

an epithet sufficiently expressive of contempt. I will only add one subject more, and everything else may be safely left to your own good sense and prudence. Learn to understand, and to speak and write the English language correctly—this is the foundation of all knowledge, and for this purpose, I would recommend to you Murray's larger Grammar, and Blair's Lectures on Rhetoric; these works are the very best of their kind, and have never been surpassed.

That this little Treatise, which is inscribed to you, may have some influence in directing your taste to natural and useful studies, is the earnest wish of

Your affectionate father,

JAMES GLENN.

New York, 17th February, 1846.

CONTENTS.

MISCELLANEOUS REMARKS.

PREFACE.

In submitting the following treatise to the public, the author deems it proper to state, that, although he has advanced opinions directly at variance with the received doctrines of the most eminent philosophers, yet he makes no pretensions to scientific attainments; and the discoveries which he presumes to have made, have been the result of what is commonly called mere accident, and they relate principally to the nature of heat, a subject about which philosophers never could give any satisfactory explanation, and in this matter they have acted like blind people, groping their way in the dark, sometimes approaching the right path, by a very devious course, but never attaining their object. The manner by which the author discovered the real nature of heat, it is not necessary to state here, as he has done so minutely in the body of the work; but he would remind his readers that great discoveries are sometimes made by simple-minded individuals, while they very often elude the grasp of great enlightened men, who are purposely searching after them. It is, therefore, in no vain feeling of confident superiority of intellect that he offers these few pages to the world, but rather as the result of a fortunate, accidental circumstance, which a natural habit of observation has enabled him to trace out and elucidate. A discussion on the subject of heat may appear too theoretical and abstruse for the generality of readers, but we can assure them that this is not the case in this instance, but that it has an eminent practical bearing on all the arts and sciences, and the most common occurrences of life, and when properly understood, it affords a cue to the explanation of a great many of the operations of Nature, that have hitherto been enshrouded in mystery. But it is not alone to subjects already discovered that it has reference; to the profound philosopher and eminent practical mechanic, it may form the ground of important new discoveries and highly useful inventions not at present dreamed of.

It is now six years since the Manuscript was first written, and during that time he has had frequent opportunities of conversing with scientific men on the subject, and on several occasions lecturing to audiences where accident had given him an opportunity, and on these occasions he was uniformly received with marked approbation, and, with but few exceptions, his views coincided in. Having been thus fully confirmed in the correctness of his views, his first impulse was to get the manuscript published, but the want of means only has delayed it until the present time; and even now he has been under the necessity of abridging it considerably, and omitting an entire chapter of twenty-two pages, on the formation of the different strata of the earth. But although he has been under the necessity of thus abridging it, he has omitted nothing of a practical tendency, and the chapter referred to was mostly of a theoretical nature; the other corrections consist, only, of the omission of proofs and extracts, where more than one had been advanced, so that nothing is omitted that may fail to give a clear and distinct knowledge of the subject to the most common capacity.

Like most men who have revealed their opinions before publishing, the author has had the mortification of seeing some of his views published in newspapers and other sources, and has heard them advocated with great earnestness and sincerity by individuals, without any reference to the source from whence they derived them, and this conduct has induced him to abridge it, rather than delay any longer its publication. But should this treatise be well received by the public, he will give it in full in a second edition. To question the opinions of men of high standing and repute in society, is rather a hazardous undertaking; but it ought to be recollected that there are a great many fallacies entertained both by philosophers, geologists and politicians, but their great influence in society

prevents their doctrines from being brought to the test of criticism, and they are consequently received by the public as well established facts. To confirm these assertions by citing examples, is rather foreign to our subject, and seems misplaced in a preface, but that we may not be suspected of making hasty and unfounded statements, we will proceed to give an example or two in proof, in as brief a manner as possible. It is frequently affirmed by natural philosophers, that subjects become lighter the higher they are taken in the air, or that any substance, taken from the surface of the earth at the level of the sea, to the highest mountain, will weigh less. One would think that a little consideration might have shown the fallacy of this opinion; for it is evident that any material cannot be reduced in weight, unless a part of it is dissipated or decomposed, and if it weighs one pound on the lowest part of the earth, it will do so in the most rarefied air in existence. Two scales, balanced with any kind of material, will remain so balanced wherever they are taken, because the air is reduced of each scale in the same proportion; for although the atmosphere is reduced in weight, the material never is, and we might with as much propriety say that if a stone is thrown high into the air, it ought to be lighter when it falls. Geologists assure us that the pressure of the earth, at a great depth, must be very intense, so much so, as to compress light matter into solid rock. It must be evident to any practical man, that geologists, in making these assertions, had entirely overlooked one essential circumstance, that is, the adhesive nature of the materials of which the earth is composed, which precludes the idea of any greater pressure being exerted at a great depth than near the surface. All round bodies have an equal pressure throughout the whole of their substance, and had they not this quality they could not be round, they would fall into a flat or square form, and it may be owing to this circumstance that all the works of Nature approximate to a round form, a square one never having yet been discovered, except we consider fluid substances as such. It follows then, that the earth being a round body, will have no greater pressure in its very centre than near the surface, no more than what may be conceived to be exerted in a cannon ball of any size, from one of two pounds, to one the dimensions of the globe.

A round body may be conceived to be composed of arches or rings,* decreasing in size as you approach the centre, the last one being the smallest, and this last could not possibly have any greater pressure than the external one. Geologists suppose that the centre of the earth is a liquid mass; if this is the case, why dont the earth cave in, and press out this liquid matter towards the surface, which would inevitably be the case, were there such a pressure as they suppose to exist. But in all probability there is neither liquid matter nor pressure, at least to the extent that they suppose. We have mentioned these circumstances, in order to show that philosophers, like other classes of men, are liable to be mistaken, and that we consider it no arrogance or presumption to endeavor to undeceive them (however elevated their station in life) or to advance opinions which we consider more plausible than theirs. The author would further observe, that since the manuscript was first written, he has read a great many of the works of medical authors regarding the contagious nature of diseases, and he finds he has been anticipated in a great many of his observations on that subject; however, he trusts it will be found that there are still some original and useful, which may interest the reader, and on this account he has thought it best to retain them.

† A ring, cut in two equal parts, forms two arches, resting upon one another.

CHAPTER FIRST.

ON THE IDENTITY OF LIGHT, HEAT AND ELECTRICITY.

The prevailing opinion concerning the phenomena of light is, that it is a material fluid of great subtility, and that it has merely the property of communicating a series of vibrations or undulations to a peculiar fluid that is diffused throughout the atmosphere or universe. Newton has held, that light consists of actual particles of matter sent off from luminous bodies to the eye. Without entering into the merits of these two hypotheses, we will proceed to state our own views on the subject.

We consider light, heat, electricity, magnetism, galvanism, caloric, phlogiston, or whatever other name the intended substance may be called, as identical, differing in no respect whatever, excepting in the quantity and intensity of the fluid—which fluid we shall denominate electricity, for want of a more general term that might include all or each of the above designations. The phenomena of vision and sound are likewise entirely dependant on the same substance—which assertions we hope to be able to confirm by very conclusive arguments. Philosophers, in treating of light, have constantly asked themselves what is it? and to this question they never could frame a satisfactory answer. Some two or three have indeed supposed, that light and heat are modifications of electricity, but instead of attempting to show the supposed relation, a great many of them have uniformly declared, that the nicest scrutiny would never be able to detect their principles. In proceeding to the discussion of a subject upon which the mighty genius of a Newton has exerted itself, may seem to some people to be the very height of arrogance and presumption; but we do not claim for ourselves any great merit for what we are going to propose. All that we contend is, that we have merely stumbled by accident upon the key that unlocks the grand arcana of nature, and that we have arrived at this, without any great research, profound experiments, or mechanical ingenuity, and any person of very ordinary capacity might have arrived at the same conclusions, had the same subjects been presented to his attention.

I had occasion, in a pamphlet that I have published, to call the attention of my readers to the circumstance of the current of electricity being arrested and accumulated by the electrifying machine—we will now state the immediate operation that led us to investigate the nature of light. A flint struck with a piece of steel elicits sparks, and so does the flint on the pan of the lock of a musket. If we examine these operations, we will find that the act is a kind of rubbing or friction, and in fact, all blows whatever, are somewhat analagous to rubbing, let the

instruments be what they may, and at the very instant of striking, so amazing quick is electricity, that a volume of it is arrested at the very instant of collision.*

Now, some substances elicit a greater quantity than others, according to the quality of the bodies rubbed or struck, in proportion to their affinity for the fluid. Some will get warm, others hot, some red hot, and others again will ignite. Now, these different circumstances are caused by nothing else but the same substance, electricity—and its being arrested in greater intensity in some bodies than in others according to their quality. The act of sawing a piece of wood warms the saw; the hammering of a piece of iron, or the turning of it with a cold chisel, makes it so hot that it cannot be touched. Some will ask, if this is electricity, why don't it give a shock? the reason why it does not do so is very evident. The substances acted upon are conductors and they conduct it off. It requires a peculiar mechanical contrivance to give a shock, and the articles rubbed must be of that kind for which the fluid has no affinity. These explanations afford a ready solution of a great many appearances in nature that have been deemed very mysterious; forests have been set on fire by branches of trees rubbing violently together during a storm; and in the polar regions where the fluid is very intense, mountains of ice rubbing violently together, have produced an appearance to the astonished navigators as if the sea was on fire. Even the rapid descent of a cable on the side of the ship, as stated by Capt. Parry, has set it on fire. These circumstances, in our judgment, sufficiently show that heat and light are identical, and are both owing to the same cause, electricity. But we will proceed with the subject of light and detail it in a more full and distinct form.

Recurring again to the collision of flint and steel, we would observe that the spark or sparks, thus collected, is a volume of diffused electricity condensed into so small a space as the sparks, and become visible by its intensity, and powder or tinder is ignited by this means. Philosophers have indeed said, that the cause of the light by the said collision, is owing to small pieces of the two substances being ignited by the collision, but this explanation is evidently unsatisfactory, for something must ignite them, and the well known fact of light being produced by the collision of mountains of ice (as mentioned above), com-

* Had philosophers been aware, that it is a volume of electricity that is condensed at the very instant of the collision of silex and steel, they would have ascertained the true nature of light long ago. But they were in error respecting this operation, and held unmeaning, unintelligible ideas about it. Some supposing that it is an immaterial substance—others, that it is caloric set free, which, they have asserted, is the cause of small globules of silex being found fused after the operation. Hence, the most of their conclusions were false, being founded in error, and they have always endeavoured to explain the effect rather than the cause. It is evident that caloric is present in the operation—but how came it there is the question at issue. In the polar regions, vast masses of ice rubbing violently together, have produced vivid flashes of light. It cannot be said that in this instance something has ignited that caused the light, for masses of ice cannot ignite. It is therefore a fair inference, that it is a volume of electricity condensed, or light concentrated by the simple act of percussion, as we have endeavoured to explain in the text. Count Rumford could not account for the cause of heat, produced in the boring of cannon, in any other way, than by supposing it a kind of motion amongst the particles of bodies.

pletely shows that it is an accumulation of light or electricity by friction, for it cannot be maintained that pieces of ice could ignite.

It has been remarked that tinder is ignited by sparks from the collision of flint and steel. If we examine the tinder we will find that a slow combustion has commenced, and if we blow it into a flame the combustion is more rapid. After meditating on this circumstance sometime, I perceived that the operation was nothing else but a decomposition effected by means of Electricity, and that during the decomposition of any kind of matter that fluid is given out which is the cause of the Light. The combustion of fuel, therefore, or any other kind of combustion, whether Light is given out or not, is nothing else but a decomposition. If we examine the products of the ignition of a piece of wood, we will find that a body has been decomposed, and that potash ashes and a pyroligneous acid are the results, according to the quality of the wood. It would seem then that we have given a wrong name to the operation, and although in common conversation it does well enough for expressing our ideas, yet in the strict philosophical sense of the term, it is nothing else than a decomposition effected by means of the electric fluid. Instead, therefore, of expressing ourselves by saying, as is customary: " A great fire, an extensive conflagration, we shall all be burned; " it would be strictly proper and perfectly correct to say: " a great and extensive decomposition, we shall all be decomposed. " The latter clause of the last sentence is correct in any sense of the term; for death itself is but a decomposition. But if we examine more minutely into this operation, we shall find that there are different stages of decomposition. There are the incipient, the middling and the rapid kind of it, and the latter is the kind that emits flame. If a piece of wood is ignited, it first becomes red, and if kept so, it will be slow in consuming, but if urged into a flame, the consumption will be more rapid. The same remark applies to all decompositions; decaying wood does not emit light until the decomposition is far advanced and begins to rot. Here then we have the principle developed of all those kind of lights that have laid the foundation of a gross and fearful superstition, destroying the energies of both mind and body, and giving rise to a train of fanciful images, such as ghosts, wizards, fairies, and hobgoblins, distracting and rendering almost insane one half of the civilized world. It is true that religion and philosophy have both conspired to abolish this superstition; but although they have succeeded in a considerable degree, in convincing the people that these appearances are perfectly inocuous, yet their true cause was never understood. We sincerely hope that the developments we are now about to make of the true nature and origin of these appearances will have a tendency to extinguish the last remnant of that superstition.

There are only three methods by which light can be produced or accumulated. I would observe here that I use the terms light and heat to denote the same substance; the most correct expression then would be: " There are only three ways that electricity can be collected, " but I rather choose at present to use the common expression so as to make myself understood. These three methods are as follow: First, by friction; under this term are included percussion and compression.

Second, by decomposition. Third, by concentration of the rays of the sun. There is no other way that electricity can be produced or evolved. But it may proceed from an accumulated body of electric fluid already existing, as is the case with that great luminary, the sun, which we shall have occasion to notice hereafter.

We will proceed to notice the two last methods of eliciting electricity just mentioned; the first we have already enlarged upon, the second and third we will discuss more at length.

Light may be produced by the decomposition of bodies in two ways; by spontaneous and artificial decomposition. We have instances of the former in rotten wood, animal remains, such as decaying fishes, bones, animal manure (this has reference to stable dunghills), phosphorus, ignis fatuus; this last is rather the name for the light itself that has escaped from a decomposing body. These substances are all in the act of decomposing when emitting light, and even long before this appearance takes place, but this stage is only a higher degree of it. And although this process be slow in some of them, it is not the less certain on that account that this is the fact. There are a number more substances that emit light spontaneously that would be too tedious to mention, and some living bodies discharge it, as the fire fly, from which the matter discharged may be collected by a persons fingers. In all these cases of inanimate objects the bodies are decomposed and electricity is evolved, which is itself the real matter of light, and it differs from artificial light or the light of fuel, only in not being so intense or so rapid; in all other respects it is the same. The mode of communicating the action is the same, a rotten piece of wood will induce the same process in another sound piece if it is in contact with it or presses against it, and this it does in a similar manner that an ignited piece of wood will impart the like action to another piece, and this process, originally induced by electricity, is nothing else but that substance itself continually evolving by having fresh fuel subjected to its operation.

I may here remark as a very emphatic example of electricity being the cause of the spark produced by the collision of flint and steel, and likewise the cause of the ignition of tinder, that the electric fluid, as is well known, being evolved in great intensity by the decomposition of gases during thunder-storms frequently ignite a house or a ship at sea after strking it, and even fuses iron and iron chains. Now nobody doubts but this is electricity, yet from the circumstance of ignition being caused by both operations, there is every reason for believeing that it is the very same substance, although on a grander scale, that is produced by decaying wood, animal remains, &c., and by the friction of silex and steel.

A question may here be asked, why do not these substances, in the act of decomposing, produce as much electricity as the gases in the atmosphere so as to inflame the same as fuel? It is well known to chemists that gases are more inflammable and explosive (or to speak more correctly) more easily decomposed than solid substances.

The dreadful effects of lightning may be inferred from the fact, that a body of gas several hundred yards, or perhaps several miles in dimensions, may all be decomposed in one moment by the application of a light

to any part of it. It would, therefore, be a strange anomaly in nature if all solid matter decomposed spontaneously, as readily and rapidly as in an ignited piece of wood, which is done artificially. But there are some instances of this kind (although of rare occurrence) which prove that it occasionally happens. Nobody, I presume, will doubt but that there are well attested instances of spontaneous combustion. Heat and moisture are necessary to this operation—dry substances do not readily decompose spontaneously. Farmers have sometimes had their barns set on fire by crowding down their grain into them in a moist state; by this means a rapid decomposition took place, eliciting electricity in such intensity as to imflame the materials. Common salt sprinkled on moist grain or hay always prevents the above action from taking place, because this is a substance that prevents or resists decomposition or putrefaction, which is a similar operation. From its cooling nature we would recommend this substance to be used where there is any danger of spontaneous combustion.

But the most remarkable of all these circumstances is the fact, that there are well attested instances of animals, and that too, of the human species, being consumed by spontaneous combustion or decomposition.* But I will have occasion to allude to this again when treating of contagious diseases. I will conclude this part of the subject with one more remark concerning decayed wood. All those substances for which the electric fluid has no affinity, very seldom consume so rapidly as to emit light—that is, spontaneously; of this kind is the red cedar, the white cedar, the pine and hemlock. The first two, and particularly the first, can hardly be said to decompose at all, (at least, not until after a very long period.) They have been known to exist on the shores of Lake Ontario for hundreds of years after vegetation had ceased, and still standing upright, and when cut with a knife they appeared perfectly fresh and sound. May not this be owing to the lack of moisture and the circumstance of the electric fluid making no impression on them? According to our observation, it is mostly the wood of maple or hard wood that emits light in decaying.

We will now proceed to the consideration of the other substances mentioned. The luminous appearance of putrifying fish present nothing different from wood—but phosphorous has something peculiar—there can be no doubt, but that it is easily decomposed, and it is always decomposing when exposed to the atmosphere. To prevent this, it has to be immersed in water, and this fluid, when in a pure running state, always prevents decompositions.

Phosphorous is the real decomposing matter collected artificially, and is analagous to a pestilential vapor decomposing. I use the word vapor to denote a more palpable and less subtle agent than gas—and it is very likely this kind of vapor that becomes detached from a decaying body, and moving to and fro in the atmosphere. presents a luminous appearance, and this is what is called *ignis fatuus*. If this vapor were collected and condensed, it is very likely it would prove nothing else than phosphorous. Although this last mentioned substance is easily decom-

* A phosphorescent light has been sometimes observed on the persons of people dying with consumption, particularly when left in a dark room.

posed, yet there are some others still more so. Chloride of nitrogen decomposes or explodes by the mere contact of phosphorous and the fixed and volatile oils. A writer in Blackwood's Magazine, speaks of a substance that remains in the same state when kept in the dark, but a single ray of light will explode it.

A remark has been frequently made in the preceding pages, that there is more electricity passing under water than through the air. This can be shown by rubbing two pieces of quartz in the dark—a light will be produced if held under the water and, rubbed, the light will be greater—showing evidently, that there is more of it passing, or it is more easily attracted under water. A question may here be asked—why is it that the electric fluid does not consume some substances in that element? The cause of this is very obvious: water resists decompositions, and we cannot decompose any natural objects under water,* although there are a great many artificial ones that may be decomposed. It is a curious fact, that the chemical union of antiseptic liquids, or liquids that have a tendency to prevent putrefaction or decomposition produce intense cold—such as nitric acid and snow—snow and common salt, both of which become intensely cold. Any person may find a number of such examples in any work on chemistry. Chemists in these cases did not know what to make of the caloric, accounting for it one way, sometimes another; at one time it had become insensible, at another absorbed, &c. Now, these results are owing entirely to the circumstance, their being antiseptics, or substances that have a tendency to prevent bodies decomposing; and of course do not attract, although they may evolve electricity at the instant of their union.

It has been remarked, that all bodies exposed to the atmosphere decompose, some more rapidly than others. All those of rapid decomposition emit light while the others do not. Of the last kind, it may be observed, that although I have stated all bodies decompose when exposed to the atmosphere, yet there are some that dissolve so slowly that some people doubt whether they decompose at all. It is the general opinion, however, that they do, although in some it requires a very long period to effect any change. I have, therefore, classed them all as such. We shall consider a few of each in detail. First: Those that decompose rapidly. We may set it down as a general rule, that all those substances that are compounds are more easily decomposed than those that approximate to a simple or elementary substance. In fact, it would be a contradiction in terms, if it were not the case. Simple or elementary substances are not susceptible of decomposition, and, of course, do not emit light, always excepting the electric fluid

---

* I have recorded the following passage in the manuscript, of which this is an abridgment:—"All our formations are produced under water, and the atmosphere decomposes them. These two antagonistical actions are constantly operating in nature: compounds are constantly being decomposed in the air, and simple substances constantly uniting in the water. And I am not aware of a single permanent combination taking place on the surface of the earth except through the agency of water. It is true that animals and vegetables are formations, but they exist only for a very limited period—comparatively speaking, they soon die and become decomposed into their original elements.

itself, which is the origin or essence of light. All gases are readily consumed, and being of a homogenous nature their whole volume is decomposed at once. Wood is easily decomposed; and it is this quality that renders it good for fuel. Electricity decomposes the great majority of substances, and it is the agent in decomposing fuel. Although the process is different from the manner by which Sir Humphrey Davy decomposed the Alkalies and Alkaline earths, yet the agent is the same in both cases; and it is probable, could as high a degree of heat be obtained by means of fuel, as he did by the matter of heat itself electricity, the result, most likely, would have been the same. We might mention a number more of these substances, but enough has been said here and elsewhere to explain our principles.—Second: Of those that are difficult to decompose. There are a great number of this kind, but we shall select only a very few, and those only best calculated to elucidate our principles. Iron is hard to decompose but not so much so as some others; but it will serve better to illustrate and explain the action of electricity, or caloric, than any other material that we are acquainted with. Iron oxydises, by exposure to the atmosphere: Now the oxydising is nothing else than a slow kind of decomposition effected by means of the electric fluid. If a piece of iron is heated to whiteness, it scales off quick, and a part of it is decomposed. The action is the same in both cases mentioned, only the latter is the most expeditious. Iron may be heated by percussion, and even made red hot by that means; this I have repeated before, but I will explain it more fully here.* Every blow with a hammer attracts a volume of electricity—a part of this remains in the iron and a part disperses—what remains heats the iron and decomposes a part of it; it is the act of decomposing that retains it. Were it not for this fact, we do not see why electricity, the matter of heat, should not pass off instantly, only retaining so small a portion as enters into the composition of all bodies. Every body that is perceptibly heated, and retains that heat for any length of time, is undergoing a partial decomposition; the effect of this process may not be perceived by the naked eye, but still the operation has occurred in a slight degree. This explains the reason why baked wood is a nonconductor, when before being baked it was a good one. It also affords an explanation of the circumstance of the magnetic property of iron, being destroyed by strong heat or hammering. Slight percussion induces the magnetic property of iron, or collects the fluid in a slight degree, but violent percussion collects too much of it, and induces a slight decomposition of the iron; and the oftener that iron or wood is subjected to the process of decomposition the less is it fit for retaining electricity or the magnetic property. This also explains the reason why soft iron conducts electricity quick, or is quickly magnetized, while it as readily loses it;

* The following plan is recommended in Smith's Chemical Laboratory, vol. I p. 227, for making iron red hot by hammering:—

Take a round iron, about an inch thick; at one end thereof fix a round iron knob, then begin gently to hammer it under the knob, turning it quickly round, and by following your strokes harder and harder, the iron will heat of itself, and begin to be red hot; because the knob keeps the heat, on each of the motions, from passing off.

that is, it has been so often subjected to the process of decomposition, that the action is easily induced and easily lost. If a piece of iron is made hot, and placed beside a magnet, and then taken and suddenly plunged into cold water, it will be found to be highly magnetized. The sudden cooling of the iron in this instance has hardened it, and arrested a portion of the heat, or electricity, or the magnetic property. But if this operation were attempted a second, third, or fourth time, it would be found that the frequent heating had rendered it unable to retain the heat for any length of time, and that it might be highly but only momentarily magnetized.

Chemists have attributed the appearances exhibited during the decomposition of matter (particularly those recently exposed to the atmosphere) to the absorption of oxygen. Oxygen is a component part of the air, and is a supporter of combustion; but that it can be the cause of this action I cannot well perceive, and we think it far more probable that the electric fluid is the principal agent in decomposing every thing except in some artificial cases. We will endeavor to show by a few arguments, that the extract which follows rather tends to favor our principles more so than it does the author's.

HABITUDES OF IRON.

"Mr. Wilson lately presented to the Asiatic Society of London, a paper upon the spontaneous heating of cast iron, when brought into the air after it had been for many years under salt water. Several instances of this action were stated; the most curious of which were, that some cannon balls raised in June, 1836, by means of a diving-bell, from the ship *Mary Rose*, which sunk in a naval engagement near the Isle of Wight, in July, near 300 years before. These balls all became hot on exposure to the air and fell to pieces" Mr. Wilkinson stated also, "that the cast iron grating, which had been immersed in the porter vats in the large breweries of London, grew hot when the porter was drawn off, and from a similar cause."

We have asserted in a former part of this treatise, that all our formations are produced under water, and the atmosphere decomposes them. But this refers, of course, to artificial combinations. We are well aware that there are some substances formed artificially by man that water will decompose, of which kind is iron, mentioned in the extract above, which, we believe, has never been found in a state of nature, pure. It would seem that after the space of 300 years the iron got carbonised, and when exposed to the atmosphere it grew hot and fell to pieces, and Mr. Wilkinson attributes this result to the action of carbon acid and oxygen. We believe carbonised substances are the result of the agency of fire, and how this could be effected by either carbonic acid or oxygen we are at a loss to conceive. We think it much more reasonable to suppose, that this result was effected by means of electricity, considering the great attraction that iron has for that fluid; and this being the essence of light and heat, reduced it to the state of carbon after a great length of time. There is more electricity passing under water than there is through the air; but water resists its decomposing effect, and therefore the iron in question retained its form 300 years, but the moment it was exposed to the atmosphere, there being nothing to resist the decomposing effects of electricity, it fell immediately to pieces. It is very probable had the iron remained exposed to the atmosphere one-twentieth part of the time that it did under water,

it would have been all oxydised and reduced to earth. The same remark applies to the cast iron gratings immersed in the large porter vats in the breweries of London.

Mr. Wilkinson further remarks, that the cast iron protectors which have been fixed to the copper bottoms of ships got suddenly reduced to carbon by the galvanic action of the two metals. Our opinion of this operation is this—iron has a greater affinity for electricity than copper, and of course it would attract more, and prevent it from entering the copper in its vicinity, and as electricity is a powerful agent in decomposing objects, the iron would be the soonest decomposed. Copper, silver, and gold are good conductors, but they never retain heat or electricity so long as iron, as they approximate nearer to simple substances than the latter. We are well aware, that salt and acids have a corroding effect on iron, but we feel very much inclined to dispute the assertion, that oxygen could reduce iron to a state of carbon, or that it has the effect of generating heat. We think it is an entirely mistaken view of chemists, in supposing that either light or heat is generated by oxygen, except in conjunction with some other substance, and then it is in the act of decomposing. We are not aware of a single instance that can be cited, where oxygen alone has been the sole cause of light, but examples innumerable can be produced, of electricity being the principal cause of both light and heat, of which we have already stated some cases. There is but a small proportion of oxygen existing in comparison of electricity, and we cannot see the propriety of attributing so much to it while electricity exists every where, and in all substances, although from its great rarity it is only known by its effects. It is then a reasonable conclusion, that both light and heat of every degree are entirely owing to electricity.

We have said that all those materials which aproximate to a simple or elementary substance are the most difficult to decompose; of this kind are gold, platinum and silver. We believe that gold approaches the nearest to a simple or elementary substance of any other solid, for it has never been analysed that I am aware of. It is true, it has been fused or dissolved by the action of fire, but it loses but little by that operation, nor has it ever exhibited in its fusion or dissolution different ingredients, its great malleability and ductility is owing, doubtless, to this property. * Platinum may be as simple a substance as gold, but its peculiarities are not perhaps so well known. We consider the peculiarity of gold the strongest proof that we can produce in support of the theory that we have been advancing, namely, that all substances which are compounds, decompose when exposed to the atmosphere, and that this is effected by means of the electric fluid, and during their decomposition

* The following remarks are contained in the London Penny Magazine for 1832, page 110: "Gold is the most perfect conductor of heat, more so than any other substance in nature; thus while the conducting power of a rod of porcelain is represented by a velocity of 12, of lead by 179, by iron of 374, the velocity of gold is 1000. Gold may be exposed for ages to air and moisture without undergoing any alteration, and a quantity has been kept for thirty weeks, in a melted state, in a glass house furnace without the loss of a single grain, and without any change in its nature. But if a small portion of it be intensely heated by electricity or by the oxy-hydrogen blowpipe, it burns with a greenish blue flame and is dissipated in the form of purple powder.

electricity is given out. Now it will follow, if gold is the simplest solid there is, that neither electricity nor the atmosphere will have any action on it ; at least, not until after a very long period. Now we all know that this is the case, it loses or decomposes the least of any other substance by a strong heat, and the atmosphere makes scarcely any perceptible impression on it until after a very long period. It neither rusts nor corrodes by the action of gross putrifying substances. I am aware that there is a diversity of opinion amongst chemists about gold, and they class it in the list of oxidable metals. But they mostly agree that gold and platinum are the most difficult to decompose of any other metal. It is asserted by chemists that gold is the best conductor of any of the metals, but they do not state whether it retains any portion of the conducting fluid as long as iron. A very simple experiment, that any person may make, will show that it does not. Take a coin of each of the four metals, gold, silver, copper and a piece of iron, hold them all in the fire for a short time with a shovel or fire tongs, and after they are heated, take them out and expose them to the air. The gold piece will cool remarkably quick, the silver next, then the copper, the iron remains hot the longest of any. Now I would ask : how is this heat or electricity retained in the iron if it is not in the act of decomposing ? We all know that the electric fluid escapes from any objects that are conductors if they are not undergoing that action, and they cannot be fixed in a perceptible hot state without a continued operation of that kind. The iron then, in that state, is unquestionably undergoing decomposition, and at that rate, although it requires a great length of time to consume, still this circumstance does not militate against our assertion that it is decomposing.

We will now proceeed to the consideration of the last of the subjects we proposed discussing, namely, that light may be produced by concentration of the rays of the sun. On this subject we shall be very brief. It has long been known that objects may be ignited by concentrating the rays of the sun into a focus, and burning mirrors have been constructed and a great many of them so arranged that by concentrating the rays of the sun on one spot the metals have been melted, and even earths that have been deemed infusible. This operation has been frequently performed by different individuals and it was once accomplished by the celebrated naturalist, Buffon. It has been a matter of surprise to us that these facts did not confirm philosophers in their suggestions or suppositions, that light, heat and electricity was a modification of the same substance. In all their descriptions, they are every now and then, detecting some close resemblance, but quite unable to trace the connection. It is evident in the operation of concentrating the rays of the sun, just referred to, that the results are the same as those we have frequently noticed with electricity. In the one case a volume of electricity is condensed by the electrifying machine, or evolved by the decomposition of the metals in the electric battery, and in the other case the rays of the sun are concentrated, and in both cases they decompose objects. Now this evidently shows that the two fluids are identical and that electricity is an accumulation of light.

Philosophers have said that electricity possesses all the colors of the

spectrum—here then is another close resemblance; we have always contended that the variety of colors in electricity did not indicate that there were different kinds of the fluid, namely, positive and negative, vitreous and resinous. We believe that these varieties in color and states is entirely owing to the nature of the substances that the light shines upon or passes through, and to the intensity of the fluid. It is contended that because a prism of glass exhibits different colors that light must naturally be possessed of them, but this effect is only owing to the nature of the materials which the light shines upon, and to the position in which the prism is held, in some positions no variegated colors will be displayed. If light really consisted of different colors, it would impart these colors to the prism in every direction. An acid will redden vegetable blues, but nobody contends that the acid is red, it is only a property of that substance to do so, so we affirm of light, it is colorless but possesses the property of causing different appearances of color according to the quality of the substance it acts upon. *

It has been a favorite method with philosophers to account for a great many phenomena in nature, by supposing that all bodies are in different electrical states, and that the changes which take place in them are owing to the degree of electricity which they possess. The great and justly celebrated Sir Humphrey Davy attempted to account for the nature of chemical affinity, by supposing all bodies having an affinity for each other to be in different electrical states, and he accordingly terms them electro-positive and electro-negative bodies. We may be mistaken, but it appears to us that some bodies combine which are in the same electrical state, and others will not unite that are in different electrical states. Water and oils will not combine, although in different electrical conditions; gold and silver will form an alloy, and alkalies and grease will unite, that are in nearly the same electrical state. It appears to us that simple substances more readily unite than compounds, and the reason of this is very obvious and natural. When a compound substance is decomposed by chemical or violent means of any kind, its constituent parts will again seek to be united the first opportunity that occurs, and this law of nature is universal, and is constantly operating. Compounds are constantly decomposing, and simple substances uniting. I will here explain a remark just made, although it is rather out of place. We have formerly observed, that electricity had an affinity for substances of an acid or alkaline nature. Some persons may think that this contradicts the statement just made, that alkalies are not positively electrified, or that the electric fluid has but very little or no affinity for them. It will hold true, as

* The following is a note taken from an author whose name we have forgotten: "The electrical aura which seems to be the principle of inflammability in its purest form, being made to pass through a quantity of fixed air, inclosed in a glass tube in which also is contained water tinged blue, with turnsole, litmus or cycanus, is known to diminish the air very considerably, and to change the color of the fluid to a red, the same as if one of the mineral acids were present."

A great many substances become red by heating. An infusion of red cabbage is blue, but becomes red by heating. Nitrous acid gas and red oxide of mercury have their red colors increased by heat and diminished by cooling. This we consider a further proof of our assertion that heat or electricity is a subtle acid.

a general remark, that the electric fluid has but very little affinity for substances that approximate to a simple or elementary nature, because in that state they are less capable of being decomposed, although they may be good conductors. While, therefore, an acid or an alkalie remains combined with other materials as a tree or water, the fluid in question will display an affinity for these substances; but when the acid or alkalie is separated and purified, it then approaches very near to a simple material that cannot be any further acted upon but with great difficulty. In our view of the case, we should term affinity to be a constituent quality inherent in a great many substances, and was originally given them when created, and is the cause of that order and variety apparent in all the operations of nature. It is evident that if the electric fluid had no particular bias for one thing more than another, it would either be decomposing everything and retained in nothing, or passing through every thing without any change being effected in the material; and instead of the harmony that now exists, we would have no such thing as fires, and the whole of creation would be utter confusion. Some people may think it very ridiculous, but it appears to us that chemical affinity is a peculiar property which impels substances to form new combinations; and it resembles love in the human species, or that particular propensity inherent in animals with which they have been endowed by their Creator for the perpetuity of the race. It seems to be the first trace of intelligence that we have in inorganic matter—a resemblance of intelligence that gradually enlarges as we advance through the different grades of animated beings, and is continued in the scale until we arrive at the author of supreme intelligence himself.

CHAPTER II.

ON THE NATURE AND COMPOSITION OF THE SUN.

Having now treated of a variety of luminous appearances in nature, which we have shown to be entirely owing to electricity, we come now to the sun, the great source of light and heat. There is a great diversity of opinion entertained amongst astronomers about the nature and composition of the sun. The most generally received doctrine is, that it is internally an opaque body surrounded by luminous clouds, and the dark spots, which are frequently to be seen, are openings in these clouds that expose to view the dark internal part. Without seeking, at present, to controvert this opinion, we will proceed to state our own view of this matter, and in order to do this, we will have recourse again to the electric fluid; for since we have shown that electricity is the matter of light and heat, of course the source of it must be of the same material.

Every person that has witnessed a thunder-storm at night must have observed that a flash of lightning illuminates everything very distinctly

within the range of vision. This light connot be said to be any other thing than a diffused state of electricity, proceeding from the body of the electric fluid itself. Call it light or rays or what you will, still it is a part of the body that it proceeded from, resembling almost in every particular the light of the sun, only not so intense. But there are different degrees of intensity of the electric fluid, and the white kind of it is the most intense of any, and, indeed, light of any kind is the most intense when it has a white appearance. But there are so many striking circumstances to show the identity of lightning and the light of the sun, that it is hardly necessary to repeat them, and we are not aware of a single quality or mode of operation in which they differ. They both diffuse their light to immense distances; this may be witnessed in a thunder-storm at night, when all the phenomena attendant on a storm are stikingly manifested. The light of the sun during the day obscures the splendour of the scene. A flash of lightning at night may be seen at a great distance, in proportion to its bulk and height in the atmosphere. In addition to these cases, it may be remarked, that chemists and electricians have detected a great many resemblances to electricity in the light of the sun, and among other things they have affirmed that the former has some difficulty in passing through a vacuum or highly rarified air. I choose the term rarified air, for I believe a vacuum cannot be formed, and there probably does not exist a perfect one anywhere in the universe. From all these considerations, I have been led to infer, that the sun itself is a vast volume of white fixed electric fluid of great intensity, and the highly rarified state of air in which it is placed, prevents its escaping or dispersing in this condensed form. We are not aware of any circumstance whatever, that is inconsistent with this idea or that in any degree militates against it. The light of the sun in coming to the earth is estimated to travel at the rate of 192,000 miles per second. Electricity is stated to travel at the same rate, another striking similarity between the two.

We have now shown that heat and solar light is nothing else than electricity. We will here give another example which we consider very striking. The great luminary we are speaking of is said, as we have already stated, to be the source of light and heat. We have already directed your attention to the identity of the flash of lightning and the light of the sun, we will now endeavour to show the resemblance between the heat of both. It can easily be imagined that, were a volume of electric fluid arrested at the very instant it was evolved from the the clouds in the atmosphere, and fixed in that position, it would warm the earth in every part within the range of its light as much as the sun does in proportion to its bulk and dimensions; and, in fact, it would be a sun in miniature. We know it would be impossible to fix it in so dense an atmosphere, there are so many conducting substances to allow it to escape, but still the supposition answers all the purposes of elucidating our idea. It may here be observed, however, that a paragraph appeared in the newspapers sometime ago, stating that a Frenchman had discovered a mode of fixing the electric spark for the purpose of giving light, but a great difficulty consisted in the apparatus of supply. We have not heard anything more about this,

from which we conclude that the artist had failed to accomplish it. And, indeed, we are inclined to think the thing is impossible, unless it could be introduced into a space approximating very near to a vacuum or even so highly rarified air as the upper regions of the atmosphere ; and we think this quite impossible anywhere on this earth.

I am aware that philosophers have said, that the atmosphere extends only about 45 miles above us, and beyond that, the air is so rarified, as almost to constitute a vacuum. With all due respect for the eminent men who have advanced this opinion, I must beg leave to say, that there cannot be a vacuum where light passes or exists, for light or electricity, which is the same thing, is a material substance,* and it occasionally becomes evident to all our senses and displays a most powerful and very sensible energy. To say that a perfect vacuum exists, where there is a material substance is an absurdity, a contradiction in terms, and it is well known that the fluid passes through all substances in a very diffused state, either visibly or invisibly. But although it is our opinion that the electric fluid cannot be fixed anywhere on this earth, (if it could, we would imitate the light of the sun,) yet it is highly probable that there are other substances besides fuel, in which it might be retained in the act of decomposing, and that too for a considerable time, and an apparatus, I should think, might be formed for heating an apartment on this principle. Iron might be heated by means of elictricity, and it retains the heat some time, but frequent heating renders it soft and then it might be quickly heated and quickly cooled. A striking proof, by-the-bye, of electricity, the magnetic influence, and heat being identical. But to return to our subject, we have said, that iron would get too soft, and might not answer the purpose of imparting heat. We should think that brick is the next material most suitable—it retains the heat a long time, and an apparatus, we should think, might be formed for imparting heat to it by means of electricity. I only make these suggestions, in the hope that some ingenious, practical mechanic may apply them in practice. Where fuel is plenty and cheap, there is no necessity for such inventions ; but where fuel is scarce and dear they would certainly be of great utility. It has always appeared to me, that the British navigators, while in the polar regions, might have invented some plan of this kind for warming themselves in these inhospitable regions, where fuel is scarce, and electricity is so very abundant. An electrifying machine in that country would undoubtedly accumulate the fluid in great plenty, and this might be imparted to bricks, or some similar large quantity of earthen ware, and these masses in the act of decomposing, might give out sufficient heat to render an apartment comfortable, and bedding might be warmed by similar means. The density of the air in those regions sometimes prevents the smoke from escaping ; if the process pointed out were found practicable, this inconvenience would be entirely obviated.

It is, we think, a strong proof of the correctness of our theory, that one subject explains another in succession, without any incongruity or apparent contradiction. Some people might ask the reason why the electric fluid being so abundant, does not warm the atmosphere in those

---

* See note in Appendix.

regions if it is the matter of heat? But the reason why it does not do so is very evident. Electricity cannot be an object imparting heat, so long as it is in motion and diffused—but the moment it is accumulated and fixed, as is the case in the sun, or bodies in the act of rapidly decomposing as fuel, it imparts heat. Could a mass of electricity be collected and fixed in the frigid zone, the climate would undoubtedly be ameliorated in its vicinity. But although, I think this impossible, the ingenuity of man may yet devise means for taking advantage of the great abundance of electricity in those regions, and by this means confer a great benefit on the inhabitants. Nature, ever provident, very often, in her greatest extremes, contains, at the same time, the very material for correcting these—but this material may remain hidden and undeveloped for a great length of time, before the ingenuity of man can discover it.

It has been a question often asked by philosophers, where is the source of electricity, or how is it supplied? We think, that we have given good grounds for believing that there exists a universal current of it continually passing through everything in nature, and it is retained longer, and in larger quantities, in some bodies than in others, and that this current exists independent of the sun, and is neither increased nor diminished as a whole, (although there may be larger accumulations of it in some places than in others,) but remains the same as when originally created.

It has been supposed by some learned men, that the sun is gradually losing its matter by giving out rays, and may yet get reduced. Dr. Priestly weighed the light of the sun contained in a certain space, and found it to contain about the 1200 millionth part of a grain, and he concluded from this data that the son would lose 670 lbs. in 6000 years. In all probability, the sun does not lose anything; but, like the natural current on the surface of the earth, it has the means of supplying itself, and what it gives out most probably returns again after fulfilling the purposes of nature, so that there cannot be one particle more or less electric fluid since the creation of the world.

It is, we think, a strong proof of the diurnal motion of the earth, that the sun is fixed and motionless; for had it motion, it would not give out so much heat as it does when stationary. And this fact explains some other circumstances regarding the heavenly bodies. It is, we think, a reasonable conjecture to suppose that the comets and fixed stars, which do not reflect light like the moon, are vast masses of electricity; but their great apparent distance, and inferior dimensions in comparison of the sun, affords, of course, a less intense light, and those that are in motion cannot, according to our principles, give out much heat. It is easy to conceive that, were a ball of fire to pass instantly before us at some distance, the heat imparted by it would be only momentary, but were it to remain fixed its heat would be constant. This would be the result with regard to the ball of fire; and the difference would not be so great, whether the object revolved, which the light and heat of the fire fell upon, or not. But it is natural to suppose that, were the object to revolve gradually round, exposing one half, one-third, or one-fourth of its surface, to the heat and light of the

ball of fire, all its parts would be more equally heated throughout. So this idea of the nature of heat does not militate against the received system of the motions of the earth with regard to the sun, but tends strongly to confirm it.

It is a very common and a very natural principle in human nature, usually denominated curiosity, not to rest satisfied, but to inquire into the nature of every thing; and I may here be asked, how came the sun containing such a vast amount of electricity to be fixed in the firmament? This is a question I am unable to answer in any other way, than by saying that it was created so by the Almighty. But the reason why it does not disperse is, very probably, owing to the great rarity of the air in which it is placed, and no conducting substance being near it.* If the sun were approached by a conducting body, or any substance of a dense nature, it would immediately disperse, and every thing in existence would be blown to atoms, it would not be proper to say annihilated, for the matter would exist somewhere in the universe; but there can be no doubt that there would be dreadful work of it, (to use a common expression,) every thing in nature would most assuredly be decomposed, as much as ever Sir Humphrey Davy decomposed the alkalies and alkaline earths by the same material. But the wise disposer of all events has prevented the possibility of such disasters occurring, and although there may be partial aberrations taking place, yet nature has the power to correct them, and the same general order and regularity is still preserved.

CHAPTER III.

ON THE ORIGIN OF METEORS.

It is very possible that the space near the sun may not remain always in the same temperature; some change may take place even there as it does every where else in nature. There is no space in the atmosphere, any where that we are acquainted with, but undergoes a change. It is, then, fair to conclude, that there are alterations in the temperature of the regions around the sun and stars—and this may be the means of

* In Gregory's Dictionary of Arts and Sciences, on the article, electricity, he remarks, "Electrical attractions appear, however, not to be so strong in vacuo as the open air. From several experiments of Beccarias we learn, that, if the air is thoroughly exhausted out of a glass reciever, the attraction and repulsion of electrified light bodies within the receiver become languid and soon cease altogether."

From this passage, it may be inferred that there is no attraction between fixed bodies of electricity, or even between material bodies of any kind, where the air is highly rarified; and although small portions of the former, in an extremely diffused state, pass through all substances, yet it cannot when accumulated to a certain degree. If ever the electric fluid will be fixed in an accumulated state by mechanical means, for the purpose of imparting light or heat, it will be done in an imperfect vacuum. But the great difficulty exists in the apparatus of supply; the same material that supplies it will also conduct it off.

detaching small masses of electricity from their external surfaces or extremities, (small bodies may pass through highly rarified air, when large ones cannot,) and these descending with a beautiful and striking appearance through the upper regions until they they touch our dense atmosphere, when they explode. This we presume is the origin of meteors. The elegant and well defined appearance of this mass as it moves along, is owing to the rarified air, for the zig-zag form of lightning is said to be owing to the resistance of our atmosphere.* We have frequent instances of masses of lighted bodies passing through the highly rarified air above us. Dr. Hally mentions an instance of a meteor whose elevation was at least 69 miles—exploding with a sound equal to the report of a great cannon or broadside. Professor Olmstead, in a lecture already alluded to, on meteorology, attempts to account for meteoric showers, by saying that they consist of light porous bodies, which take fire on touching our atmosphere. If any dependance is to be placed upon the correctness of our vision, the statement alluded to is not correct, for these luminous appearances, called meteoric showers, of which we have had frequent accounts in the newspapers, seem to be small globules of light—having this appearance at their very first expulsion from the parent body whatever it may be, and this is the impression they always convey to the naked eye, at least to those who have paid any attention to them. There is a frequent occurrence, called in common language, shooting stars, that appears to be an emission from the star of a small part of its light. We think it the most reasonable and plausible supposition that they are small masses of electricity, as we have already stated, dropping off from the external surface or extremity of the main volume, and this action is most probably caused by a change in the condition of its atmosphere. Whether this view of the matter, or that of the professors, is the most rational conclusion, I leave the public to judge.

It has been an opinion entertained for a great length of time, that some of the planets and even the sun is inhabited by living beings. It is possible that such may be the case with the moon and other planets that reflect light only. But it is utterly impossible and entirely inconsistent with the knowledge we possess, to suppose that the sun is inhabited or the comets and fixed stars that emit light, for there is nothing that bears the least resemblance to animated nature that can sustain its existence in the midst of an intense fire; and even minerals and all substances whatever (except those that are simple or elementary) are decomposed by its action. If this, then, is the case with a fire, which is only a body decomposing, the chance of any thing existing in a volume of electric fluid of great intensity is decreased in a tenfold degree, for this is the essence of heat itself. This assumption is, of course, based on the principle that our theory is correct.

* Electricity being made to pass through an imperfect vacuum formed by the air pump, has a beautiful and well defined appearance, very similar to that of meteors, passing through the upper regions of the atmosphere. From this circumstance it may be inferred, that the same fluid, electricity, is the cause of both appearances.

CHAPTER IV.

ON EARTHQUAKES.

Earthquakes are the most awful and destructive phenomena to which the earth is subject,—they are terrible in their effects, and more destructive of human life, in the countries that are subject to them, than any other cause or immediate operation of nature whatever. No wonder that, in the untutored ages of the world, such events were viewed as the workings of a fearful demon, spreading death and destruction. This was a very natural conclusion for an unlettered mind, and does not excite any surprise, but like all false conclusions, it very often gave birth to the practice of horrid rites and ceremonies in order to propitiate the offended evil spirit. Learned men have, in all ages, endeavored to trace the real cause of earthquakes, and have accordingly given disquisitions on the subject; it would be too tedious for us to mention these, and we shall, therefore, only state an opinion or two of modern philosophers.

The supposition has prevailed to some extent, that the internal part of the earth, at a great depth, is a mass of liquid fire, and the heated air generated by this and struggling for a vent, causes an earthquake or volcanic eruption. Nothing can be more absurd than this supposition, for were there such a vast quantity of igneous matter, at the centre of the earth, as they suppose, the gases generated by it would explode and blow everything above it to atoms, even the whole earth itself would be instantly destroyed. The more rational opinion of the latest philosophers about the cause appears to be this, that internal heat is engendered partially in some places under the earth by combustible matter taking fire, and the gaseous fluid generated by this, and struggling to escape, is the cause of earthquakes and volcanoes. We will now state our own opinion of the matter. We have already explained to you that heat and electricity are identical, and of course, then, we must refer all these operations to the agency of electricity. It may readily be supposed that there are cavaties or empty spaces under the earth, and, indeed, we all know that such is the fact; it would, therefore, be a waste of time to inquire how they were formed, as the fact of their existence is sufficient for our purpose. In these chambers the air, in consequence of being confined, would get impure, and become very explosive, or in other words, it would become what miners call fire or choke damp, requiring only the agency of fire to explode it. If there should be any combustibles in the spaces where the confined air is situated, this air might induce a slight decomposition of them, and this action increasing, might lead to a rapid decomposition, or to use the present phraseology, spontaneous combustion, and the instant that this took place, the confined air would explode causing the utmost destruction and setting fire to all the combustible matter within its range, and this also extending, would produce all the phenomena consequent upon earthquakes. But there is no necessity for supposing

fire damp to be the first cause of spontaneous combustion—this process is always going on under the earth, near volcanos, in a partial degree, and is never entirely extinguished, so that it has only to extend itself to a larger sphere (as it certainly does after a series of years) to produce all the dreadful effects ascribed to earthquakes. Let us now examine more minutely into its effects. The electricity generated under the earth by a large mass of ignited matter, would be very great, and supposing it was produced in such intensity as it is in our atmosphere, it would rend apart or heave up anything above it, or it might extend to distant places under the earth, very remote from the scene of action, making its escape by a lake or any other large body of water. It is, we think, a convincing proof of the agency of electricity in producing earthquakes that the effects of one is felt simultaneously in a great many places in the earth very remote from the theatre of action.

We are not acquainted with any fluid of such an amazing rapidity as the electric; and in fact, it may almost be said to be omnipresent, so instantaneous are its operations. This circumstance, together with its capability of being rapidly conducted through solid matter to vast distances, sufficiently indicate that electricity is the chief agent in producing earthquakes. Ships at sea too, in different parallels of latitude, have felt shocks at the same instant of time, and have been tossed as if on a billow, when the sea was perfectly calm—we cannot ascribe this to any other cause than that already mentioned. Lightning is frequently visible during these catastrophes and sometimes it is not, and this latter circumstance may be owing to the explosion taking place internally and becoming diffused so as to render it invisible before it reached the surface. All these statements lead us to the conclusion, that lightning is formed under the earth as well as in the atmosphere, and the former operation is called an earthquake and the latter a thunder-storm, but owing to the density of the materials, the former is by far the most dreadful in its effects.

The following is a quotation from a newspaper containing an account of lightning escaping from the earth and even tearing a part of the surface—it is an extract from the Kingston, *Upper Canada News*. I regret that I cannot give the date of the month and the year in which it happened, as the article was quoted without looking at the date of the paper :—

SINGULAR PHENOMENA.

" On Saturday evening, the 10th instant, a little before nine o'oclock, a flash of light, resembling lightning, succeeded in quick succession by two reports like those of heavy cannonades, were experienced in this town It appeared to us to originate in the northeast, and to die away, after rumbling for the space perhaps of two minutes, in the southeast. We, at once, were of an opinion that it was an earthquake. We are informed that some houses in town trembled violently. Nothing having been said about this circumstance by the inhabitants of the town, we refrained from noticing it at the time, supposing it might possibly have been a sudden report of thunder. However, we have since heard that it was felt in different parts of the district. The reader will perceive by the following communication from a gentleman in Picton, Prince Edward's district, that that district was visited by the same singular phenomena at the same time :—'Saturday evening, the 10th instant, about nine o'clock, a flash of light, like that of lightning, and a report immediately after like that of two cannons in succession, were seen and heard all over this district, and the earth trembled exceedingly. The buildings

about the stone mills and within several miles of that location were shaken so violently that it was feared they would fall. It is believed the explosion took place about a mile south of the stone mills on a lot of Mr Reynolds, in the second concession. Mr R. says he saw the flash and heard the report and felt the ground shake; he also says that about two or three years since, when he was clearing a side hill on his farm, an explosion took place which threw off several rods square of earth and stone, and that he frequently sees flashes of light about that place. He cannot find the spot where the last explosion took place. Mr R. also says, that when he was clearing the said hill it was with difficulty he could get a person to help him to log it, on account of the frequent flashes of light that were seen there. The people became superstitious and really thought some person had been or would be killed there.'"

This extract shows that the same agent is the cause of both earthquakes and thunder-storms, and the term would be applicable to them both. It would not indeed be proper to call the former a thunder-storm, for that conveys the idea of wind and rain, but if we call the action in both cases a thunder tumult, or electric tumult, it would be perfectly proper.

CHAPTER V.

PHENOMENA OF VISION AND SOUND.

The phenomena of vision and sound are the next subjects that will come under discussion. We do not intend here to give a lengthened discussion on the organs of sight and hearing, as we do not pretend to be intimately acquainted with these subjects; the intricate structure of the eye and the ear, we know very little about, and all we profess to have ascertained in this case relates entirely to the medium of vision, and transmission of sound, two subjects that have always appeared very mysterious to philosophers and they have never, in my judgment, satisfactorily explained their mode of operation.

We have already shown that electricity is the essence of heat and light; it must also follow that it is the medium of vision, but it may excite some surprise when we affirm that the transmission of sound is entirely dependant on it. Some people may think that we are attributing too much to electricity, and that it cannot be the cause of so many operations. But this objection, instead of operating against our theory, may rather be considered as an evidence of its correctness. All the operations of nature are simple and efficient, and they uniformly appear so when completely understood and developed, and mankind are frequently astonished that an agent so simple should not before have been discovered. The machinery of mankind are intricate and complex, and require a laborious application, unremitting care, and a frequent renewal of their parts. A substance, therefore, that constantly performs so many regular, beautiful, grand, and efficient operations, as the electric fluid, displays the power and wisdom of the Creator in a most eminent degree, and is, we repeat, rather some proof of the correctness of our theory than otherwise.

We shall only make a few remarks on the sense of vision, and then ve shall consider that of sound in a separate chapter It is well :nown that some philosophers consider light to proceed by an undu- ıtory motion, and others again profess the atomic theory—that light ...particles of matter sent off or issuing from the parent body; the ɔrmer doctrine is the most in repute at the present day. The colors .' the spectrum and the different refrangibility of the rays of light, ıve undergone a great deal of learned discussion, and for aught that ve know on this head, their experiments and deductions may be per- ·ctly correct. Upon this subject we do not mean at all to enter; it s sufficient for our purpose to know that by their experiments they ıave ascertained, that the electric fluid exhibits the same colors as the ight of the sun—a circumstance that we have often wondered did not .ead electricians to consider it the same.

There is nothing so wonderful in chemistry as the effects sometimes produced by apparently very insignificant means, but this is infinitely more displayed in the study of electricity. If, for instance, a candle is lighted in the dark, it will be seen if nothing obstructs the view anywhere in the circle of a mile. Now this, we contend, is owing to the electricity given out during the decomposition of the wick and tallow, and has diffused itself in the whole area of this circle, but not so intense as to make other objects visible. The reason that our visual organs become sensible of this lighted candle, is owing to the homogeneous nature of the fluid that extends in one unbroken line from the burning body to the eye, without any break, disagreement, or vacuum. If there existed any of these, we could not possibly see the object. If the scene around us were illuminated by a flash of lightning, we could see every object very distinctly, because the flash is more intense than the lighted candle, and this displays the homogeneous nature of the fluid more strikingly, for wherever we cast our eyes we see objects distinctly, showing conclusively, that the fluid that touches a tree at the distance of a mile is the very same that impinges on the retina of the eyes. And this remark will hold equally true of the solar light—another proof of its identity with electricity. This light after the flash passes becomes invisible, and so does the light of a candle after it is removed; and the matter probably goes to increase the latent current or returns by some unknown operation to the sun. It requires, then, a constant emission of light from a body decomposing as the candle, or a fixed mass of electricity as the sun, to keep up a constant supply.

It will be seen from these remarks that although the philosophers' theory of undulations may explain the reason why the object emitting light may be perceived by the eye, because the waves or undulations have extended to it, but it does not explain why other objects can be perceived by that organ. A tree, or an animal at a distance does not emit light in waves or particles, or by any other method, so as to impinge upon the retina of the eye. According to the theory alluded to, it would require an extended wave, a wave large enough and long enough to embrace all the objects within the range of vision, otherwise the eye could not perceive them. This kind of motion conveys the idea of empty space intervening between every undulation, and of

course, the perception of vision could not extend beyond each wave. And, indeed, this objection applies to both directions, horizontal and perpendicular, to the luminous object. The same objection applies to the theory of atoms, although not to such a degree, for the very term particle, or an atom, implies distinct bodies having spaces between them, and the faculty of sight could no more reach from one to another than a ship at sea could sail over a space of dry land in order to get to another body of water. We may be asked, "if that is not the method, how then is light propagated?" We have already endeavored to illustrate this by directing your attention to the circumstance of a flash of lightning, and we will now go a little more into detail. This flash, we contend, is a flood of homogeneous light having no space between any part excepting where sensible objects interpose, and it may strictly be said to be an unbroken, continuous flood of light. It may here be stated by the abettors of the former system, that, call the operation what you will, still it is particles or waves. We dispute this assertion and we maintain that the two methods of expression convey very different ideas; the one signifies an unbroken line of fluid and the other does not. We will illustrate this point still further by adopting that liquid, (water) for explaining our ideas. It is an infinitely denser medium than light, and does not exactly represent what we wish to convey by it, still it is the best that we can think of, and if you will allow the supposition, for the sake of argument, that it is the medium of vision, it will answer our purpose. We will suppose then, that water is the medium of vision, and that from a vast reservoir in the atmosphere, a stream or flood of it is poured down upon the earth. This would be a continuous stream, and a person standing in the middle of it would see through the whole area of the circle and even perpendicularly to the reservoir itself. But if the stream diverged or parted in any degree in falling from a great height, the perception of vision would be entirely obstructed—it would not then be a homogeneous fluid and the individual alluded to, instead of seeing through the whole circle, could only do so through a divided portion of it. But we will give another example, exhibiting only an horizontal view. Supposing a person were immersed in deep water in a river, his view might extend in each direction of the river a considerable distance. But if the river suddenly receded, leaving its shallows dry, his view would be entirely obstructed; beyond these he could not see anything. This we consider to be an illustration of the manner in which light is propagated, that is, it issues from the luminous body in continuous streams, and not in waves or particles. To say that the sun pours down upon us a flood of light, is, perhaps, as correct an expression as our language can supply.

We intended to have inserted here a chapter on the nature of sound, showing that what is called sound is a volume of electricity attracted and dispersed, and produces the sensation of hearing by striking on the tympanum of the ear. Also a description of an acoustic telegraph, by which sound may be propagated much further than is generally imagined. But this plan has been superceded by the electric telegraph, and to state arguments showing sound to be identical with electricity, would lead us into a repetition of a good many of the arguments already advanced; we shall, therefore, leave this subject to a future opportunity.

CHAPTER VI.

ON CONTAGIOUS DISEASES.

Before entering on our subject, it may be necessary here to state, that we make no pretensions to a knowledge of medicine, more than what any individual might be supposed to receive from general reading and observation; nor have we ever practised that art, or ever been in the habit of administering medicines to any person as a calling or profession. What we are therefore going to relate, resulted naturally, and followed, in consequence of discovering the properties of light and heat, and not from any intimate and very accurate knowledge of medicine. All that we pretend is, that we have discovered the nature of some general principles that physicians themselves were in doubt about.

There are a considerable number of contagious diseases, but we will only consider those that come under the terms of fever, and cholera morbus or Asiatic cholera. These two classes of diseases are essentially distinct, and exhibit different symptoms, but I intend to show that they all have their origin, in the same chemical process of nature; that is, although the virus that produces the disease be different in each class, yet the peculiar operation by which the morbific is generated, is the same. I am aware, that some physicians have contended, that the Asiatic cholera is not a contagious disease, and that a difference of opinion exists amongst them with regard to this subject. I do not mean to enter into a discussion of nice distinctions, between contagious, infecfectious, specific, and epidemic diseases; I do not profess myself equal to the task; and the fact only that these diseases may be communicated is sufficient for my purpose, and this we think nobody will dispute; and, in fact, the most of diseases may be communicated, but the above terms are generally applied to such as are very rapidly or readily extended, for it is not easy, in a good many cases, to draw a line of distinction. All eminent doctors have referred the origin of contagious diseases to the effluvia, arising from filth and dirt, putrifying substances, stagnant marshes, decaying vegetable matters, when accompanied with heat and moisture, and a peculiar state of the atmosphere. This, we believe, is all relating to these disorders, that mankind have as yet been able to ascertain, and they have not pretended to any knowledge of the real nature of the virus or morbific matter that is thus generated; and there are a great many conflicting opinions about the mode in which it progresses. We intend to offer a few observations on both these difficulties or mysteries, but our remarks on the latter will be the most satisfactory—those on the former will only be probable.

We have divided the two classes of diseases of which we mean to treat, into fevers and cholera morbus, or the Asiatic cholera only, and that will be sufficient to develope our principles. We shall begin, then, with fevers. We have already explained to you that all matter decomposing is evolving electricity, and that combustion is a more rapid condition of the same process, and all substances with few ex-

ceptions, however slow and imperceptible the action alluded to may be, still they are undergoing decomposition, and this term includes combustion, putrefaction, and fermentation. We do not, indeed, apply the term combustion until we perceive flame. We have different names for different substances, as oxydizing, decomposing, putrifying, and fermenting. All these terms, strictly speaking, are the same operation—a body has been decomposed in them all, and new ingredients are the result. Heat and moisture are necessary to a quick decomposition—a very rapid kind of it takes place in dry substances as in the case of fuel. One kind of matter putrifying will impart the same process to another kind in its vicinity, provided it is a body of similar nature. A small quantity of matter fermenting will produce the same action in another similar kind of substance that was entirely sound, and a piece of ignited wood will ignite another piece. From these conclusions, I infer that contagious diseases are a kind of decomposition or combustion, and propagated in the same manner as in the substances already alluded to. But the virus circulates more rapidly amongst living beings, as mankind, in consequence of their habits of intercourse, their trade and commerce. A person seized with a fever may be said to become like a brand ignited, and if the virus is powerful he will be speedily consumed; if the act of administering antiseptic medicines, and the principle of vitality do not arrest it. We are apprehensive that the virus affects the blood first in fevers, and in cholera, the stomach and viscera, and arrests the progress of digestion; but we shall have occasion to refer to this again. There are a great many circumstances to be taken into view, regarding the different kinds of fevers—some are more powerful than others, according to the strength and quantity of the poison imbibed, the situation of the country and climate, the habits of the people, and state of the atmosphere. The yellow fever, probably the most virulent of any known to America, is generated in warm climates, and amongst a people filthy and dirty in their habits, and who are at no pains to guard against infection of any kind, their preconceived notions of religion very often forbidding them. Amongst such people, pestilential disorders become endemical, and it is said that the plague never leaves Constantinople in Turkey, or Alexandria in Egypt.

I have said that a body putrifying or fermenting induces the action in another body of the same kind, and again to a third and so on, "*ad infinitum.*" But were the same process attempted to be imparted to a totally dissimilar substance, it might impart an action of an entirely different kind. Thus for example: Beef putrifying may cause another piece of meat to putrify, but it would have a different kind of action on vegetable matters, such as wheat flour, potatoes, or apples; these would decompose by moulding. In like manner, we are not to expect that when fever takes place in man, that it is the very same process that was operating in the substance from which he originally derived it. He is a living being and a different body, and the action may be quite dissimilar, that is, the peculiar species of it, but still the same remedies may apply to them all. Pure cold water, the fresh air of Heaven, antiseptic medicines, such as acids, salt and water, nitre and

preparations of gold, allum, chloride of lime, lime water, &c. But I may enlarge on this hereafter.*

The original matter then that produces the morbific effluvia, incites a different action, in a different body, but the same, or nearly the same (allowing for a difference of strength and condition) in similar bodies. It sometimes happens, however, that a person laboring under a mild disease, may generate the virus of a contagious fever. I have known a good many instances of this kind, where people attending on consumptive persons have been seized with fevers. But then, the second person would always communicate the same kind to a third, &c. It is well known that in hospitals, where a good many sick are crowded together, that they very often generate a highly virulent fever, totally dissimilar in all its symptoms from the disease of any one of the invalids. But this disorder thus generated will continue the same in its progress, throughout the race, until it gets modified by medicine, country or climate. This is analogous to what takes place with some chemical compounds—the union of different gases, or different ingredients will sometimes form a compound of a totally different nature, and possessing qualities quite contrary to any of the original subtances.† We will now state our opinion of the manner by which fevers are propagated—that is, fevers of the most virulent foreign kinds.

The yellow fever or plague is unquestionably first generated by the effluvia arising from filthy, putrescent matter, located in the midst of a large city, and thus uniting with the evaporating substance from exceedingly filthy people, produces a virus that is extremely mortal, particularly to the human species. The virus then, originating from decomposing matter rapidly extends itself by attcking objects or human beings the most suitable to its nature, and decomposing them, and the same operation is thus induced, and the poisonous matter kept active. Were suitable objects withheld from it and no intercourse kept up with the uninfected parts of the world ; in all probability the malady would be stayed, and it would spend its force amongst the people that had originated it. If this inference is correct, it follows that our quarantine laws and regulations are well founded, as well as other modes of preventing intercourse with infected districts and countries, and that the common sense of mankind is most generally correct. But though precautionary modes have a tendency to arrest the rapid progress of the disease and sometimes to destroy it entirely, yet it is not in every instance strictly adhered to, and some communication is had, which gives a chance for the dreadful scourge to fasten on new victims. The disease is frequently mitigated and sometimes entirely stayed amongst a people habitually clean and circumspect, which circumstance evinces the true nature of the virus, and that anything which has a tendency to prevent decomposition is salutary and beneficial. Excessive cold weather very often arrests the disease altogether—another proof of our theory, for there is nothing of an inanimate nature decomposing during

* See note on the Chloride of Lime, in Miscellanous remarks.

† Zinc and copper form brass—a metal quite dissimilar to any of the parent substances. Hydrogen and sulphur forms sulphurated hydrogen, a very noxious gas, while the two primitives are entirely innoxious.

very cold weather, excepting fuel, which is done artificially. From these facts, it would appear that it is possible, by universal attention to cleanliness, to prevent the recurrence of these diseases altogether.

The yellow fever only visits the largest seaport towns in the United States, and but very seldom extends itself to the country. The impure air of our large cities is, no doubt, the cause of this, and the healthy fresh air of the country weakens or neutralises the virus, or to use a common expression, it gets extinguished like a fire, for want of fuel to feed on. No wonder that our large cities are termed the sepulchres of the human race, when we reflect on the filth and dirt to which they are exposed and the impure air which they habitually breath. It would be well now to state what we should think the best remedies in this class of diseases—this I have already hinted at, and may resume it hereafter; in the meantime, I may remark that all diseases originate in the decomposition of matter, and the disease itself is only the decomposing process continued, but the virus is, no doubt, greaty modified by peculiar circumstances. The toothach itself is, strictly speaking, a decomposition, the action differs in no respect from a piece of rotten wood decaying. The tooth, indeed, does not decompose so rapidly as to emit visible flame, like the former, because the superabundance of moisture in the mouth prevents this, and the smallness of the object would, at any rate, prevent the circumstance from being seen; in every other respect the action is the same. The rotten piece of wood will communicate the same action to another piece, if it presses against it, and so will one tooth to another. The same substance will assist in destroying the action in both. All antiseptics, lime water, chloride of lime, allum, preparations of gold, &c. It is a false notion which some people have and frequently practise, to wash their mouths with inflammable substances in such cases, as ardent spirits; this is like adding fuel to the flame. The above anticeptics will cause an alleviation of pain, but there is nothing, perhaps, that will effect a permanent cure; we cannot restore a tree that is half decayed.

There is one trait in the character of some infectious diseases, and more especially in the small-pox and measles, that I have not seen accounted for anywhere, that is, that they never attack the same individual twice. It would appear from this, that there is something in the system which is decomposed, and which renders that condition of the virus, or that particular species of morbific matter ever afterwards inoperative in the same individual, resembling in that instance a kind of powder that will give a flash on the application of fire the first time, and yet remain perfectly good for every other purpose. If something could be found to decompose this matter in a more mild form than the action of the original virus, as is the case with the vaccine matter, it might lessen the virulence of the disease.

Some of our remarks regarding the origin and progress of the yellow fever will also apply to the Asiatic cholera, and as it is a subject on which much has been written, and the public are completely surfeited with it; we will omit the entire article in the manuscript from which we copy, except a few remarks of a practical tendency relating to the means of cure, which we subjoin.

I have some reasons for thinking that the Asiatic cholera originated with a vegetable and animal virus combined, and that the yellow fever is produced by an animal poison only, that is, from decaying animal matters. But whether this is the case or not, there is one mode of action which renders the two diseases essentially distinct. The virus of fever, like the poison of animals, affects the blood first. The effluvia of cholora, like mineral and vegetable poisons, affects the stomach or seat of digestion, and weakens or destroys that organ.

The means of destroying or preventing the approach of the virus may be inferred from what we have already stated regarding the yellow fever. These are habitual cleanliness; removal to an airy situation, and never put two sick people in the same apartment, as the combined effluvia escaping from two would be much more fatal than that from one. Abstain from a vegetable diet as much as possible, that is, garden vegetables, or any which are of a very juicy nature, excepting those that are acid, and eat salted provisions and dry bread with butter that is new, good and well salted. Avoid all moist, wet, fresh, or unsalted provisions; and particularly that lain over from a former meal; for the virus of cholera, whether native or foreign, fastens on wet substances and decomposes them. The use of the metallic substance, gold, would be a most excellent preventative, but it would only be the wealthy that could afford to use it. Its qualities of this kind are owing to the circumstance that we have already explained, that is, it is the most difficult to decompose of all substances, except platinum; and it will remain even in the midst of putrefaction for a great length of time without any sensible impression being made on it. From its great tenuity, it might be formed into threads, and woven into cloth, to be made into dresses, for the purpose of preventing contagion. It is frequently given as a medicine for purifying the blood; but physicians have been in the habit of administering it without being aware of the principles on which they acted. Disinfecting agents are, no doubt, highly salutary and beneficial, and so are fumigations if they consist of the proper substances, such as antiseptics, for being of a contrary nature from the virus they have a tendency to neutralise or destroy its effects. The observation sometimes made, "that fumigations only disguise the real virus, and is rather injurious than otherwise, is not founded in truth, and is a contradiction in terms. In all severe cases of disease, it is certainly the best way to call a physician immediately—they are practical men, and for that very reason alone they are best qualified to judge, if they are judicious, and without this latter quality no man can be relied on in any situation. There are some poor people who are unable to procure a physician, and to such we would recommend a few simple remedies that may be within the reach of all, and these are suggested from a knowledge founded on this theory, for we have no practical knowledge of these matters. It is necessary first to recollect that a poison has been imbibed into the system from a decomposing substance or person, and this poison induces the same action as it did in the body that it was derived from, always excepting the first matter that originated it. If then the action is a kind of decomposition or combustion,

which I have shown to be the same operation, then the best plan would be to apply remedies to quench it. We cannot see any harm in a person drinking cold water during a burning fever, or during the stage of violent thirst and heat in cholera, provided the patient be accustomed to it by degrees, in small quantities, and if it is slightly acidulated so much the better. But a most beneficial operation would certainly be to wash or sponge frequently the patient's face and hands, and even his whole person if convenient, with warm water, slightly acidulated with vinegar, or some other acid; it might be mixed to such a degree as not to injure the texture of the skin. This would prove of great benefit to the patient and attendants, as it would have a tendency to remove and destroy the pestilential matter exuding from the person. Common salt is a substance which prevents putrefaction and combustion; it preserves meat, and quenches flame or fire. It must, therefore, in some way or other be of benefit, either taken internally or otherwise. Charcoal likewise resists putrefaction, but it is an inflammable substance, and on this account may be doubted, whether it would be so proper as the former medicine; all inflammable materials, such as ardent spirits of all kinds, are very bad, but they are sometimes given when the crisis of the disease has passed, in order to stimulate the exhausted functions of life.

CHAPTER VII.

ON THE VIRUS OF CONTAGIOUS DISEASES.

It would be a most beneficial discovery could we ascertain the exact chemical properties of the morbific effluvia of diseases. It would lead us to select, with unerring certainty, the most proper medicines for its remedy. "The knowledge of a disease is half its cure." But the knowledge of the real chemical properties of the virus would be still more so, for we could then select such medicines, as would have a tendency to neutralise its effects. But this is a subject that has eluded the investigations of the most diligent inquirers into the operations of nature, in every age of the world. It is a remarkable fact, that physicians and chemists have not as yet been able to ascertain even the poisonous matter contained in the sting of a bee, much less the virus of hydrophobia, although one would imagine, that the morbific matter of these two is much more palpable than the virus of fevers, as they are never communicated but by contact with the infected person or animal, and then it must be infused into the blood, for it would seem it is not of such a subtle nature as to pass through the pores of the skin. Whether, therefore, the matter is a new simple substance, that has not yet received a name, or whether its designation already exists in the nomenclature of chemists I am unable to say; but all nature has been ransacked for remedies for hydrophobia, and the explorers have not

as yet stumbled upon anything even by mere random, that can in any way alleviate the disease. It is very true, that Dr. Jenner discovered the virus of small-pox in the teats of cows, and hence originated the practice of vaccination, but the real matter of the virus has not as yet received a name, at least I am not aware that Dr. Jenner ever named this substance It is very likely that all those diseases which attack mankind but once, such as measles and chin-cough, might be mitigated by innoculation, and probably the virus exists somewhere in nature as well as that of the small-pox. But all we mean to do in this case, is to point out some substances in nature that bear a striking resemblance in their operations to the poison of fevers ; and although we cannot put our finger on the particular virus of every kind of fever that we could name for certainty to be such, yet it is making the attempt—it is entering the threshold and may be the means of inducing ingenious, practical men to enter and explore the interior. It is very evident, that the morbific matter of fevers resembles very much in its operations the poison of animals, such as the venom of serpents or spiders, but only the matter of the former is more diffused than that of the latter. In these it is highly concentrated, and when introduced into the blood it causes speedy death. But still a good many symptoms are the same in both cases. A person stung or bit by a poisonous animal, is instantly involved in great distress of mind—he soon raves and talks incoherently, and is often seized with vomiting, and is subject to great perturbation of the mental faculties. If the patient recovers, the part of his person that was stung or bitten, becomes swelled and remains an obstinate, troublesome sore. If we allow a little for the rapidity of the operation of poison, we cannot perceive much difference between it and that of fevers, and even that difference does not always exist—for, in some countries, the plague carries off its victims in less than ten hours. There is one very striking similarity—the swelled, troublesome ulcer which is left after the operation of poison, is analogous to the tumid ulcerous sores of fevers ; in both cases, the poison does not entirely leave the system. Romyn Beck, in his work on Medical Jurisprudence, mentions a great many instances of persons being bitten by poisonous animals, where it left a troublesome ulcer very difficult to cure. In fact, the resemblance is so nearly alike, of sores remaining after fevers, and those remaining after the operation of poison from animals, that physicians cannot distinguish them. It will not, we think, be urged as an objection by any one, that because the poison is secreted by a particular insect or serpent, that it could not exist anywhere else. Nature has a great variety of ways and means of producing the same substance. One kind of matter may be found embedded in the earth, and the same kind may yet be discovered in vegetables and animals, and even in the atmosphere. Iron for example, although a mineral, has been detected in a vast variety of substances. Dr. Jenner discovered matter analogous to the virus of small-pox, (as I have already stated,) in the teats of cows, and hence originated the practice of vaccination. In like manner then, diseased persons may be generating a poison in an extremely diffused state, similar to that elaborated by poisonous animals in a highly concentrated state. And it is probable, could the effluvia of hospitals containing persons sick with the

yellow fever, be collected and condensed, it might exhibit the same substance. Different diseases may vary a little in the kind of morbific matter they produce, but there can be no doubt, that an individual laboring under a contagious disease, is as certainly generating a poisonous effluvia as any other vegetable or animal matter that is decomposing; and although we cannot in this instance give the substance a name, yet the resemblance to another poison which we have pointed out may not be without its benefit.*

CHAPTER VIII.

ON THE VIRUS OF CHOLERA.

A GREAT deal has been written on the cholera, both in pamphlets, books, periodicals and newspapers, so that the public are satiated with the subject. We will therefore omit, from the manuscript, the greater part of what we have written on this subject, and insert only the following observations:—

The virus of fevers, we apprehend, is an animal poison, but that of cholera, we presume, is vegetable; for this opinion we will proceed to give our reasons. The poison of animals affects the blood and has no effect when taken internally. Vegetable poisons affect the stomach and viscera. It is affirmed by natural historians, that individuals have frequently been known to swallow large doses of the poison of animals and serpents without suffering any inconvenience. But the noxious qualities of vegetables always produce bad effects, and in their operations they exhibit a striking resemblance to the symptoms of cholera. There is one vegetable substance in particular that we doubt much whether it is not the same matter as the virus of the cholera, and that is "Tartar Emetic." If this is not the same substance as the virus, its mode of action on the human system is exactly similar. Lewis Beck in his system of chemistry says: "Most commonly Tartar Emetic is evaporated by vomiting before it can produce any striking constitutional effect, but in cases of poisoning, when large doses have been administered, and it remains long on the stomach, burning pain in that organ comes on, with purging, cholic pains, violent and long continued vomiting—cramp is also common. The resemblance of these symptoms to cholera morbus will strike the physician." It is very true, that notwithstanding the resemblance between the symptoms of these two poisons they may be very different in their natures. But we

* When fresh, the poison of serpents is a transparent fluid, of a yellowish green tint, slightly glutinous, and when dried becomes viscid and adhesive. Chemical tests show it to be neither acid nor Alkali. It has no peculiar smell, and applied to the tongue it produces the same sensation as grease: it is only deleterious when mingled with the blood; hence its effects are more terribly and speedily developed when the quantity is great, and when it is directly infused into the vein or other blood-vessel.—*Chambers' Edinburgh Journal, Feb.* 24, 1844. *Article on Serpents.*

have no means of ascertaining the real nature of anything but by comparing it with others, and if the similitude is very striking, it affords good grounds for believing it the same. Although chemists have not been able to detect but two substances or at most three, existing in the atmosphere, constituting air, yet there cannot be a doubt but there exists as many distinct ingredients or gases in the air as there are primary substances in the earth or water ; they are, no doubt, very much diffused, and this is the reason why chemists have not been able to detect them. The nicest chemical analyzation cannot discover the malaria of swamps, and yet it undoubtedly exists in the air. The same may be said of a grain of musk that will scent the air to a considerable distance ; and the effluvia escaping from human beings that is cognizable by the sense of smelling possessed by dogs, who, by that means, trace out their master by the scent of his footsteps. Plants and vegetables elaborate different kinds of fluids according to their natures, and it is contended by naturalists that they receive more from the air than they do from the earth ; it follows then, that the different ingredients exist in the atmosphere. All substances in nature then, are contained in the air in a gaseous, or highly rarified state ; in water, in a less rarified state and in the earth in a solid state. If these statements are admitted as correct, the cause of contagion and the progress of diseases become perfectly simple and easily understood. In the first place, the morbific matter is generated by decomposing substances ; if any human beings come within its range they will get attacked, and they, in their turn, will generate the poison and keep it active, and extend it through the atmosphere ; at certain distances the virus will become so diffused, that people will only be partially affected, until the contiguity of some new victim adds new power to the destroying malady. It is of no consequence whether we say that the disease has been communicated by contagion or through the atmosphere, as both cases may occur. The immunity of some individuals attending sick people is no proof of the non-contagious nature of the disease, it only shows that such people are proof against the disorder whether communicated by contagion or the evil influence of the atmosphere, just as some people will live in a swamp, in the very midst of malaria, without feeling any inconvenience, while a stranger might be very susceptible of the disease. A nurse in an hospital suffers no inconvenience, while the organs of a stranger are extremely susceptible of every impression.

CHAPTER IX.

MISCELLANOUS REMARKS.

We will now conclude with a few miscellaneous remarks, that we could not conveniently introduce any where else. Although every thing exposed to the atmolphere decomposes, yet heat or electricity is the agent that effects this, and we cannot perceive why a great many substances in nature should not exist for ever, were they always to remain in a frozen or very cold state. It is heat, together with moisture, that ultimately decomposes every thing, and it will hold true as a general occurrence, that those materials which conduct heat quickly, and do not retain it, last the longest or are the most difficult to decompose. Of this kind are gold, silver, platinum, &c.—and if we examine wood also, we will find these remarks verified ; that kind which retains heat the longest, is the soonest decayed, such as beech and maple, the charcoal of which will retain heat much longer than that of pine or cedar, which loses its heat shortly after the flame expires. This explains the fact, of the electric fluid being conducted through the former timber, while in the latter it is prevented, and the electric current probably acts more on the one than the other.

A gentleman in France has discovered a method of impregnating trees, by immersing them in a liquid when newly cut down, and he recommends as the most durable material for this purpose, a composition of iron. I am satisfied that this is a mistake, for iron will attract heat, and will decompose sooner when exposed to the atmosphere, than most kinds of pine or cedar ; that is, if it is not painted or japanned. Mechanics are well aware that iron attracts heat very readily, except it is oiled, or greased, and as this substance is a non-conductor of electricity, it of course prevents it from decomposing so soon. Where there is a good deal of friction applied, mechanics prefer using copper or brass, as they conduct heat more readily than iron, but do not retain it so long ; constant practise in their profession has enabled them to discover this effect without being aware of the cause. Cast iron attracts less heat by friction than wrought iron, and requires less oiling ; millwrights are aware of this, but none that I ever conversed with could assign a reason for the cause. Our explanation of the case is the following : The more pure and hard iron is, it will attract heat the more readily, as is the case with steel, while the less pure that metal is, it attracts the less ; such being the case with cast iron that contains much dross or earthy matters.

A great many of the terms used in philosophy and chemistry, are only relative terms, and ought not to be used in the strict literal sense of the word, although a great many eminent authors have done so. Thus we say, a conducting and a non-conducting body : this has only a reference, or ought only to have to the degree of the intensity of the fluid. It is well known that electricity will pass through all bodies whatever in a very diffused state, but in an intense degree it will only pass through

conducting bodies, and there are some instances of very intense degrees, when it will not even pass through the latter—it has been known to explode on, and to fuse the tips of lightning rods. The same remarks apply to the word sublimation,—we say that a substance sublimes when it rises by the heat of a furnace, and is condensed, and becomes sensible to our faculties of sight, smelling, and touch. But there can be no doubt, that a great many deleterious substances sublime and rise into the air by the heat of the sun, (as we have already observed, when treating of contagious diseases,) although they are not perceptible to our senses—there is no other way of accounting for the different qualities and juices that plants and trees exhibit, but upon this principle, that they elaborate them from the atmosphere. A great many of the diseases incident to human nature are, no doubt, caused by inhaling a noxious, poisonous substance from the atmosphere, which is evaporated by the heat of the sun, and is too minute to be appreciated by any of our senses; but the body, by continual exposure to it, gets contaminated.

We apply the terms, elementary and primary, to a great many substances in nature, while, in fact, there are but very few that are such in reality. All the metals are said to be original materials, but there are none of them except gold and platinum but what may be said to be compounded of other substances, and these two exceptions may be said to approximate only to simple elementary materials.

It has formerly been a subject of controversy, whether there can be such an occurrence as spontaneous combustion. It is now fully confirmed, and we think that we have fully shown that there can, and that all substances decomposing are undergoing combustion, which is only a different name for the same process. But what is generally meant by spontaneous combustion is that rapid stage of it exhibited by ignited fuel. We have already detailed several circumstances under which ignition might have taken place, and it would be needless to repeat them here; we will, therefore, only advert to one circumstance, which has alway s appeared a most extraordinary and very mysterious occurrence, and that is, the fact of human beings being consumed by spontaneous combustion. There are several well attested instances of this kind recorded in *Becks' Medical Jurisprudence*, and other works. It always excited the utmost astonishment of mankind where it happened, and even the author himself expresses his astonishment at the occurrence. It is very natural to expect that a rare or uncommon event, should excite some consternation amongst a people unacquainted with the real cause, and it may have this effect in some degree, when the real producing agent is well known. But if a knowledge of the cause will only lessen the fear and dread of the inhabitants on such occasions, and procure for the subjects of such visitations some care and attention, our remarks may be of some avail. After the closest comparison that we can make, we cannot perceive much difference in the act of spontaneous combustion alluded to, and the circumstance of rotten wood emitting light, decaying animal matters, (such as the heads of fishes, &c.,) and the phosphorescent matter of the *Ignis Fatuus*. From several circumstances narrated in the account, it would appear, that those events occurred at night, and this circumstance would render the light visible—had it occurred during the day, it is probable,

no light would have been observed, for we do think, it was of so rapid a kind of decomposition as that of fuel—for, the physician who was called in on one occasion, handled the person, and the lighted matter adhered to his fingers without injuring or burning him. The same circumstances may be exhibited with phosphorus and all phosphorescent lights. *Ignis Fatuus* would not burn a person, and it generally recedes from an individual who is following it. This peculiar action then, is nothing but a rapid kind of decomposition, (although not so rapid as burning fuel,) induced in the person, in consequence of the habitual use of ardent spirits, or some other obvious cause, and instead of its being a preternatural, spontaneous combustion, (as the author inconsistently asserts,) it is as much a natural operation as the action of all kinds of matter decomposing, and resembles very much in its appearance, the vapor called *Ignis Fatuus*. It is very remarkable, that in one instance, where the individual recovered, he stated, that when the combustion commmenced upon him, he felt a shock as if some person had given him a blow. This fact evidently shows the connection of electricity with substances decomposing, and tends to corroborate what we have uniformly stated on this subject, that electricity is given out in these cases which is the cause of the light.

A great many accidents and dreadful catastrophes are constantly taking place, by the bursting or exploding of steam boilers ; and it seems it has lately been discovered in England, that there is electricity in steam, and some experiments have been recorded in the newspapers, proving this to be the fact. Whether this may be the means of exploding a boiler they do not state that we have perceived. But whatever may be their conclusions on this subject, we think we have endeavored to show, with some degree of truth, that electricity is produced in all bodies which are hot or partially so, and also in fire and flame or any thing in the process of combustion. There are so many conducting substances built up with steam boilers, such as iron, stones, and brick, that the electricity evolved by combustion has means of escaping. Brick, however, is not such a good conductor as the two former. Mr. Moore, a tallow chandler in Philadelphia, according to an account published in the newspapers, had a boiler full of melted tallow blown up through the ceiling of his house, supposed to be by the explosive force of steam doing a great deal of damage, and a similar event to this occurred to him once before, within a short period. Similar accidents to this have happened to other tallow chandlers, who were in the habit of melting their tallow by means of steam. It would be foolish in us to attempt to state, with certainty, the real cause of this catastrophe, but there is one circumstance connected with their occupation which might be the cause of the accident. Grease or tallow, we all know, is a non-conductor of the highest class ; and this being used in such abundance in and around his boiler might prevent the escape of electricity evolved by combustion, and an explosion would follow in consequence. We have often observed a great deal of grease on steam boilers, and a great many of them are painted or varnished. While every means ought to be used to prevent the escape of steam in the construction of boilers, yet the escape of a much more subtle fluid

ought to be taken into consideration, or it will most assuredly make way for itself with a vengeance, and in that case great strength of boilers would be of no avail whatever. It is much easier, in most cases, to find fault than apply a remedy, and we cannot see how the use of tallow could be dispensed with in a steam engine, particularly on the piston or any place where there is friction; but care ought to be taken to prevent its application around the steam generator. We are apprehensive that copper boilers would be preferable to iron in preventing an explosion, as it is a better conductor of electricity, but if grease or dirt were allowed to collect on it, it would be equally as bad as any. The expense of copper is considerably more than iron; we would, therefore, recommend the following plan, which we hope may be found efficient for the purpose with any kind of metal for boilers. Let a rod of copper be suspended from the inside of the boiler directly above the water, the whole length or breadth of the boiler; it might have several branches, and each branch, together with the principal, might terminate in a brush of points. The other end of the rod might be carried through the top of the boiler, to the distance of two or three feet above it. This rod, if kept clean, might prevent an explosion by conducting off the electricity when concentrated into great intensity; the force of the steam might be somewhat lessened in consequence, but this would be only in a trifling degree. If the expense could be afforded, a rod of silver, of small dimensions, might be used, or a very small one of gold might be used with still better effect than any, as it is the best conductor of any of the metals.

There are so many accidents constantly occurring in consequence of powder igniting by friction, percussion and compression, that a hint on that subject may not be found unnecessary. Everything that is in any way connected with powder or any very inflammable material ought to be made of non-conducting substances. The rammers of cannons ought to be made of that kind of wood that is a non-conductor, such as cedar or pine, which would prevent the ignition of the powder while forcing down the shot. The powder used on such occasions is generally enclosed in a woollen bag—a good precaution, but it would be still better were the bag made of cloth painted or varnished. All the instruments used in powder mills or powder magazines ought, as much as possible, to be made of soft wood; hammers, for some uses, ought to be made of hemlock or pine knots. Philosophers have asserted that the great force of powder is owing to its being converted into a great many times its own bulk; we are inclined to think that it is owing to the great amount of electricity produced by the sudden decomposition of the powder, as is the case in the firing of cannon, and being confined, it makes its exit by the weakest part. We are apprehensive, that if it were possible to make cannon of copper, there would be but few instances of their bursting, as it is a good conductor, but the force of the powder would undoubtedly be considerably diminished.

It would seem that all the substances that the ancient Egyptians used in embalming, were non-conductors of electricity, such as bitumen, pitch, resin, wax, linen, &c. Whether they adopted these materials from a knowledge of their non-conducting properties I am unable to say.

But this remark may be of some use to the moderns who do not seem to be aware of the fact, "that all objects are much longer preserved when they are enclosed in non-conductors of electricity." Upon this principal we would suggest that coffins made of soft wood, such as cedar, pine, &c., are much more durable than those made of hard wood, or even of iron of any kind. The attendants of Napoleon Bonaparte did not seem to be aware of this fact when they enclosed his remains in a tin and some mahogany coffins. A lead one, however, is good, as that metal has but slight conducting powers. It is doubtless owing to this property, that light woods are frequently found imbedded in the earth to a considerable depth, in a perfectly sound state, while hard wood trees are hardly ever discovered in that situation.

MATERIALITY OF HEAT OR LIGHT.

It has been maintained by some eminent philosopers, and still is, to this day, that light, heat, or caloric is not a material substance. It is a matter of surprise to us, how any person can be found to assert such a palpably inconsistent doctrine. If we give a name to anything, it must have an existence, and if it has no existence, we cannot give it a name; and to assert the contrary, is like saying, that something is nothing, or nothing is something. But there might be some show of reason for this doctrine, were the subject under discussion invisible, but as it is perfectly apparent to our senses of sight and feeling, all reasoning on this head must fall to the ground. But there is one view of this subject that has, no doubt, influenced immaterialists in maintaining their side of the question, that is, that the human soul is immaterial or immortal, and that, therefore, other subjects to which we give a name may, in like manner, be immaterial. We confess that this subject would not now have been brought under the notice of our readers, had we not felt perfectly convinced that we can explain this subject in a manner perfectly satisfactory, both to the philosopher and the divine; so that both may join issue in promoting the great work of virtue and morality, without compromising any of their principles (save the bare abstracted one of the immateriality of the soul), or injuring the cause of religion in the smallest manner. Had we been aware that it would have this latter effect in the least degree, these paragraphs would not have been penned. It will be a source of much pleasure to us if these remarks, which we subjoin, will conduce to harmonize the two classes of which we speak; on one question, at least, on which there is a wide difference of opinion. And we trust, that sincere, pious people, will weigh the subject well before passing a hasty judgment upon it. When a living body dies, it is only the organization that is destroyed, all the constituent parts of which it was composed, remain in existence—there is not one of them annihilated. It follows, then, that the soul being a part of that body will still exist, although a material substance, for it cannot be destroyed, and when the divine power sees fit again to unite it to some kind of body according to the common creed of Christians, the idea is far more readily conceived by the understandings of the majority of mankind, that material substances can again be united than if they did not exist, and had to be created for the pur-

pose of being again organized into a body. The soul of man is immortal in any view in which we can place it, and it matters not as to this point whether we consider it material or immaterial, only being considered in the former sense, it will reconcile it to the principles of philosophers without disparaging any of the main principles of christianity, a result certainly of no small importance. But it may be urged here, that the Bible favors the doctrine of the immateriality of the soul. We doubt this very much, and are inclined to think that the simple, inspired men who form the principal characters of the Bible never conceived the same ideas of it that the moderns do. And this mystical, mysterious doctrine was introduced into the schools during the dark ages after the death of Christ ; and constituted a fertile subject for the most nonsensical disquisitions, and unmeaning jargon ; it may, therefore, be justly considered as one of the yet remaining, unexploded nonentities of the schools. It is true, that it is plainly declared in the Scriptures, that the spirit is invisible ; but, although this declaration is made, it is not asserted that it was actually nothing ; on the contrary, according to the best judgment which we can bring to the subject, and viewing the Scriptures as an unprejudiced person, it appears to me that they uniformly declare it as something, although invisible, and this is the more remarkable, for invisible gases were not then discovered, and anything not apparent to their senses, might, very naturally, have been considered as nothing. There is no excuse, however, for the moderns adhering to the said view of the question, for numerous gases have been discovered that are not apparent to our sense of vision, but are known only by their effects ; and it is a curious fact, that there are some fluids invisible, but are yet sensible to our sense of touch, as for instance, muriatic acid, when pure. But leaving all controversy on the subject, we will proceed to state what we consider to be the soul, or vital principle of man. When the galvanic battery was first discovered, it was conjectured, that the cause of the action ehxibited by it, was identical with the vital principle. In this view of the subject, I have no doubt, they were .correct—for the galvanic principle has now been proved to be identical with electricity. But I will proceed to show several reasons for entertaining this opinion. If we compare the brain of man to a galvanic trough, we will find a great many very striking resemblances. The fluid generated in the trough, by the decomposition of the metals, through the action of a diluted acid, passes instantly along the wire to any conceivable distance, and returns again, let the circuit be ever so long. Let a man will to touch an object, and he does it instantly, and the sensation is communicated to his brain, by a continued circuit of nerves, similar to the wire in the trough. If we consider the soul of man, vital principle, or nervous fluid, to be electricity, the resemblance between the brain and the trough is very striking.

Were a man to have his arms lengthened to the distance of several thousand miles, and the brain no larger than it generally is at present, he would still be able to touch objects at that distance, the moment he conceived the desire, and the result would be as quickly known to his powers of conception in the brain. So the great distance of the wire

from the trough, or the nerves from the brain of the man, would make no difference as to the quickness of communication. Again, the materials of the trough have to be supplied, after using a certain time, or the machine would cease to perform its functions; so the animal has to be supplied with food, by the decomposition of which, he supplies electricity to his brain, or he would become disorganised and die. The trough has to be regulated, and a liquid formed of a certain strength, so that it may not generate too much or too little of the fluid; so man has to keep up an equal temperature in his person, so that he may not have too much nor too little electricity. If he is cold, he warms himself by friction, taking exercise, or eating and drinking for that purpose, and if he is too warm he cools himself. But, the last and most striking analogy is the following:—If the wire leading from the trough is cut through in any part of the circuit, badly bruised or seriously injured in any manner, the electric fluid will not pass—so, if a nerve is divided, the member to which it belongs cannot any longer perform its office.

Paris, in his *Medical Chemistry*, says, p. 232—"From the experiments of Dr. W. Philips, it would appear, that when a nerve is divided, so as entirely to intercept the transmission of its action, the place of the nerve may be supplied by a galvanic apparatus. This assertion he attempts to prove by experiment upon some rabbits." Sir Chas. Bell was the first that made the important discovery, "that the sets of nerves which obey the actions of the will, are not the same that convey the sensations to the brain," that is, as I understand it, the nerves form a circuit proceeding from, and terminating in the brain, after extending through every part of the body. From these considerations, it would appear, that the brain of man is supplied with a certain portion of electricity which constitutes his life; and that he possesses the power of keeping up a regular supply according to the exigencies of the case, by the decomposition of food and other means; that it is by this subtle fluid that he thinks, wills and reasons, and when the body gets worn out, by long-continued use, or gets disorganised by violence of any kind, the portion of electric fluid departs from the worn out tenement, and whether it returns to the sun, the great source of electricity, or forms a part of the vast globes of light by which the heavens appear to be studded, there to remain until again united with other elements, is more than I can possibly ascertain; but this I can truly say, with a full conviction of its truth, that it is material, and cannot possibly be annihilated. If these remarks should be justly appreciated by all denominations of christians, we shall consider ourselves as having assisted the cause of religion and morality in no small degree.

ON THE MEANS OF DESTROYING INSECTS.

Mankind have effected a great deal, in destroying vermin and insects of all kinds, which used to infest their persons and habitations—but nothwithstanding all that has been written on the subject, they have done little or nothing towards exterminating the different races that exist in the open fields—the weevil and the caterpillar with a host of others occasionally make their appearance as numerous as ever, to the great injury of the crops, plants and vegetables of all kinds. We are apprehensive that electricity may be made a means of destroying

these, and even everything which has animal life ; and although we cannot point out at present, the precise mode how this is to be accomplished, (our present avocations not allowing us to indulge in experiments) yet we will state enough to show, that it is within the bounds of probability.

In order to a proper and better understanding of the whole subject, we will make a few preliminary observations on insects, and the simplest means of effecting their destruction before having recourse to electricity. Some people are so extremely humane in their feelings, that they consider it an act of cruelty to kill animals of any kind ; and they maintain that it is contrary to the intentions of Providence, who allowed them to exist—that it is also impolitic, for if one class is destroyed it favors the increase of others ; and they state in support of the latter remark, that if a certain class of birds are all killed, it is followed by the production of numerous insects. We will not spend time in disproving this,doctrine for it is our decided conviction that all noxious animals, whether birds, insects, rats or mice, may be swept off the the face of the earth, without not only doing injury, but conferring the greatest benefit that the human race ever received. In fact, we all know that much nobler animals than those we have mentioned, have long since ceased to exist ; their types no longer remaining, without mankind experiencing any inconvenience in consequence, that we are aware of. By unremitting attention to cleanliness in their persons and dwellings, mankind have accomplished much ; but what they have effected in this department, by means of soap, hot and cold water, the broom and the mop is destined, we think, to be achieved in the open fields, by the frequent use of the plough, the harrow, hot water and steam, and the galvanic trough. It is truly astonishing what may be accomplished sometimes, by very simple means, when great exertions and expensive appliances fail.

We recollect a complaint being made in our hearing, about the troublesome nature of these nauseous insects, bugs, which gave rise to a discussion on the best means of exterminating them ; steaming, taking bedsteads to pieces and scalding them, had been tried, as well as the application of paint, oils, acids and other fluids without permanent benefit. We suggested the following plan which proved a most effectual one, and attended with but little trouble and no expense, and we can recommend it, to all housewives as being a most effectual method of extirpating them. When you make up your bed, remove all the bugs you perceive on the bed clothes, but as they retreat to the holes and crevices of the bedstead, on the approach of day light, few or none, may be found. Then have a tea-kettle full of boiling hot water on your stove, and after all the clothes are removed from the bedstead—pour the hot water from the spout of the kettle into all the holes and joints of the bedstead, and every place where you may suspect they harbour, even on the floor or side wall. This effectually kills them, with but very little trouble, for the water may be wiped from the floor or the bedstead, by means of a mop, and the water being warm, it very soon dries. All this operation need not occupy more time than fifteen minutes, and it will be found to have completely extirpated the said insects ; but should any be discovered afterwards, it will be an easy

matter to repeat the operation any time you are making up your bed, and those that escape the first scalding may suffer in the second. Since our residence in New York, we have had occasion to suggest the above plan to several individuals, and it completely answered their purpose. The plan of taking the bedstead apart—scalding it, and putting it up again, is a tedious and troublesome operation, and cannot be often repeated without great inconvenience—oils, paint and bug ointment are quite useless and very disagreable, from the odour they emit, and their tendency to soil the linen.

There is another method of destroying insects, by electricity, which we will shortly describe as being applicable to the earth, but for the above purpose, the plan detailed is the least expensive, and most effectual that can be used. In considering the best method of exterminating noxious insects from land, we must acquire some knowledge of their history, as this will the better enable us to devise means of destroying them. We must recollect that most insects lay their eggs in the fall of the year—very few of them survive the winter in our cold climate. These eggs are hatched in the spring, and the class now hatched lay eggs during the summer, several times, and produce two or three generations—some of these begin to fly as soon as they are hatched, others crawl for sometime and gnaw every tender plant they fall in with, until at last they become flies, and move off in quest of some other food—such is the case with the yellow bug, that does so much injury to young cucumber vines. Some farmers are aware of this and do not sow their cucumber seed until the bug has become a winged fly, which takes place about the latter part of June. Some insects pass through several stages of existence—the first from the *ova* or egg, is the *larvæ* or grub, (farmers call them grubs,) meaning a class of insects, but the name relates only to the stage, as there may be a hundred kinds of insects which pass through this stage of existence. The second stage is the nymph or *pupa*, and the third, the fly. Some insects, in their grub state, though seemingly sluggish, are very voracious, and do a great deal of injury by eating through the tender stems and shoots of plants and seeds. From the circumstance of insects laying their *ovæ* in the autumn, and expiring during cold weather, it is evident that were their eggs destroyed in the fall of the year, or their grubs in the spring, the race would get exterminated, as there would be no parent left to propagate—there are some exceptions to this remark, as the mosquetoes, whose females sometimes survive the winter, and lay their eggs in the spring—there are few however who do this. But there is a distinction to be attended to, in two classes of insects, that is of consequence. One class is generated by a parent, like other living beings, the other class is produced by the disease of plants and vegetables, stagnant water, and the putrefaction of animal remains. Means may be found to destroy the first class, but to extirpate or prevent the introduction of the second will be a difficult matter, particularly those that relate to diseased vegetation, and unfavorable seasons. Too much wet, or too much dry weather, will engender disease in plants, and when in this state, they very often favor the production of insects, but as we cannot control the seasons, there is no remedy for this occurrence. I am aware that the

question is much disputed—" whether an insect can be produced without a parent ?" We incline to the affirmative ; but we have no room for entering into a discussion on the subject—all that we mean to show is, that there is a possibility of exterminating, or at least greatly reducing the numbers of all insects, except those that are produced by disease, or decay of substances—by fermentation or putrefaction of matter. The first class mentioned are by far the most numerous and destructive in their habits ; the latter class are but few in number and but short lived. Having made these remarks, we will now consider the best means of effecting their destruction. In the first place, we would recommend the constant practice of disturbing them in their retreats, particularly at the season of the year they deposit their *ovæ*. Every housewife knows, that by giving her house a thorough washing and scrubbing, every spring and fall, a great many vermin are prevented from breeding ; the same plan suggests itself in the cultivation of land, although not by the same means. Every farmer ought to plough and harrow every piece of land intended for cultivation, at least twice every spring ; the first time, he ought to do it as early as possible, and the second, at an interval of two or three weeks, or a month. The intention of this is to destroy the eggs of the insect, and to prevent their incubation, by exposing them to the cold weather, by the first ploughing and harrowing. At the second, the insect in its grub state would be easily destroyed. If to the process of ploughing and harrowing, we add rolling, the benefit would still be greater, as it would have a tendency to bruise the *ovæ*, and crush the grub. If the farmer could afford to have this operation repeated, both in the fall and the spring, it would be a great improvement. The cause of the great difficulty with winter wheat, we surmise, is this—it is a biennial plant, and requires about a year to bring it to maturity—of course, the agriculturist has to prepare and sow his land early in the autumn, after which time, a great many flies and insects deposite their *ovæ*, and remain quite undisturbed until they come to maturity by the heat of the sun, in the spring, and then they sometimes effect the complete destruction of whole fields of wheat. The process recommended will, therefore, only apply to those plants that are annuals, or that require less than a year to bring them to maturity, such as spring wheat, corn and oats. The next plan that we would recommend, is steaming of the land. A steam generator, with its furnace, might be placed on the carriage over the top of the roller, having a horizontal slit at the bottom, in rear of the roller, of from one to three feet in length, according as the case required, to permit the escape of the steam. This jet of steam would impinge upon the land, and scald all insects on the surface. Hot water completely kills all insects—we have never seen one that withstood it, except those which are enveloped in a shell. It wilts plants, but does not kill them, as they frequently flourish after the operation. It may be objected to these plans, that the expense and labour is too great, and that the additional improvement in the crops would not compensate the labour bestowed. But this is a subject that experience alone can decide ; if the augmentation of the crops were sufficient to pay for the expense and labour only, it would still be an improvement, as it would

give employment to an additional number of human beings, instead of contributing to the subsistence of millions of insects. There is great pleasure resulting from the contemplation of both animals and vegetation, in a thriving condition, and if this result is obtained, without any profit, the improvement paying only for the labour bestowed, it is still a very desirable object; no public benefit was ever yet obtained, without laborious application, and unremitting care; and it is truly astonishing what persons possessed of these qualities may not accomplish—there is hardly anything possible that they cannot reach. Every person can perceive the difference between an animal kept clean, brushed and rubbed, and one that is neglected and left to itself. The same remark applies to everything else; if we do not make great exertions, great results cannot be expected. It has always appeared to us most unreasonable, for farmers to complain of their sheep being diseased and dying, when they are kept filthy and dirty, and are allowed to huddle close together in great numbers. We might as well expect a man to be healthy with a coat of tar on his person, as to expect that sheep would be healthy under such circumstances. It does not signify what part of the body is affected by disease, (whether foot-evil or head-ail)for if the trunk is kept disordered, the extremities will soon be infected. To enter on a discussion of this kind is foreign to our subject, which was to propose destroying insects by electricity; but we have been led into this incidentally, from the necessity of considering all possible means of destroying noxious vermin as well as those we intend to propose by electricity, which is only problematical. With regard to the sheep, I may further remark, that it is not a native of this climate, and that in the countries where it is indigenous, it is covered with long hair only. The growth of wool, therefore, is artificial, and is, no doubt, the cause of the unhealthiness of the animal. In its former state of nature, all dirt, filth and perspiration would pass readily from its person, by means of hair—but in the case of wool, the whole covering is tangled together, and clotted with dirt; and all kinds of filth and vermin are allowed undisturbed possession, which, no doubt, keeps the poor creature in a state of continual suffering, and at last engenders disease. But the question occurs, how is this to be remedied? We have occasionally recommended the following plan to farmers, but never could succeed in getting any one to make the experiment. Keep the sheep apart at night as much as possible, and for this purpose, a slight penn or shade might be made, composed of the simplest materials, such as wicker work or slight boards; let this be put up the length required, and roofed, and then partitioned off into stalls like a stable, and two sheep put into every stall, with a clean place to lie on. This would keep them secure from harm during the night, and prevent the bad habit of huddling together. Let this system be commenced immediately after shearing, and let a man be kept purposely to attend to them every night they are put up, and have them also rubbed with a brush or any other instrument most convenient. This practice would keep them clear of vermin, and it might have a tendency to make the wool grow in one direction, instead of being clotted with dirt and tangled together. This plan might be persisted in for a consi-

derable time after shearing, until the wool got so thick, as to render it inconvenient. If sheep, by this superior management, were made to produce one pound more of wool in the course of the year, and if they were found in better condition for killing—and the average of deaths much fewer—it would certainly pay for all the additional trouble expended. If this plan were found impracticable, there are numerous liquids, which might be rubbed on their backs, that are good for destroying vermin and resisting cold ; and possibly they might be shorn of their wool more than once in the year, that would have a beneficial effect. The sheep, I believe, in its natural state, is accounted a very healthy animal—but until we get iron sheep, we can never expect them to be healthy with the present usage.

We have now to consider the application of Electricity, to the purpose of depriving of vitality everything that has animal life ; I use the the term animal life, because I have reason to think that there are some kinds of vegetable existence which are not destroyed by Electricity, particularly if they are conductors—the Beach and Maple trees will stand a powerful shock without being injured. It is necessary to attend to this distintction, for if the plan we are about to propose, were found injurious to vegetation, it would not be applicable to growing plants, but only to fields previous to sowing, which would materially lessen the benefits to be derived from it. In order to commence the experiments, it is necessary to have a galvanic trough, electric battery, or voltaic pile of great power, or any other instrument that evolves electricity. The simple Farmer need not be alarmed at the name of these instruments, for all the manipulations necessary to a complete knowledge of them, may be acquired by the dullest capacity in a few days instructions. The mechanical operations of ploughing, sowing, reaping and mowing are much more difficult of attainment. When the galvcnic trough is in operation, the fluid generated by it may be passed to any length, by means of a circuit of wire ; if an insect were laid on this wire, or a fowl were made to stand on it, or even a man, the shock would not pass through them in this position, because the electricity would pass along the wire without leaving it. But supposing the wire were divided any where in the circuit, and drawn a little apart, and an insect interposed in the space between them, or a fowl, or a man made to stand with one leg on each end, the shock would then pass through them, and were it a powerful one, they would be instantly killed. Now the question naturally arises, how far can the wires be separated without obstructing the passage of the fluid ?—can they be separated a few inches—a few yards—or a few miles—having the earth or water as a conductor, and the fluid pass from one end to the other ? Mr. Morse, and Professor Wheatstone contend that it can be made to pass to a great distance ; now, although we are much inclined to doubt this, yet we think it very probable it could be made to pass in a highly accumulated state through the earth, the distance of a few yards or a few acres of land, if at the negative point, something very attractive were placed. We all know, that in the open air, the striking distance is not over a few inches, except the electricity be very highly accumulated. But we think it very probable, it could be made to pass

at short distances, in the earth or water, with sufficient power to kill every thing in a straight line, in either element. In making the experiment, the battery or trough along with the wires, could be carried to any part of the farm, and small parts operated on until the whole farm was electrified. We should think the most effective time to perform this operation is in the spring, when a great many insects are in the state of grubs, but it would be applicable at all times. We think we have now stated enough to show that the plan is at least plausible, and if it should succeed, it is hardly possible to foretell the beneficial consequences that would ensue. The circumstance of large quantities of dead fish being found floating on the water is, probably, owing to a shock of electricity—the falling down dead of flocks of fowl is probably owing to the same cause. If the electric fluid can be made to pass through the earth, in a simple state, it can also in an accumulated state—but the grand object to be attained is this: Can it be made to pass with sufficient power to destroy animal life without rupturing the ground? But this we recommend to the attention of the ingenious practical electrician.

EARTHQUAKES.

The following remarks may possibly subject us to a good deal of ridicule, but if they will have any influence in calming the fears of the people who are the subjects of these dire visitations, or raising the most distant hope in the breast of any one, that these terrible calamities may be either entirely averted, or their destructive qualities considerably lessened—we shall be enabled to bear with more composure, the contumely of the ignorant and self conceited. We think it very possible, that an earthquake may be greatly diminished in force, or at least prevented, from doing any more injury than the thunderbolt in the atmosphere, which explodes during a storm, and that too, by the same means,—namely, rods of iron placed as conductors around the foundation of houses or cities the deeper they are laid in the earth the better, and they might be made in the following manner. A bar of iron of any convenient thickness, might be laid in the earth below the foundation of the house, to as great a depth as could conveniently be accomplished, and made to surround the house until within about a foot, and then led off to the sea, lake, river, pond or any other body of water—or in the absence of this, to wet moist land, such as swamps or marshes. The distance of the body of water from the house would make no matter of difference as to the passage of the electric fluid, as it would be conducted on the rod, with equal facility, one hundred thousand miles as one mile—the expense only would be a matter of proper consideration. These remarks apply to cities, as well as to single houses. In cases of earthquakes, where the explosion has happened directly under the city, it might be of great benefit to bore into the earth, to the greatest possible depth, and insert in the spot a rod of iron, this would serve to conduct the fluid off before it had time to accumulate to a great degree. A number of such might be inserted at convenient distances. We have just seen it stated in the newspapers of the day, that iron houses in the West-Indies, stand well the shock of earthquakes. This is an inciden-

tal circumstance, tending to favor the remarks made above, which were committed to writing more than three years ago; but it is not stated whether the houses owe that peculiar property to the adhesive nature of their materials, or the conducting power of the iron.

In a chapter of this work, when treating of contagious diseases, we had occasion to remark, that all diseases are, strictly speaking, a decomposition—and the electric fluid is the principal agent in decomposing everything. If this is the case, and we think we have given good grounds for the assumption, it follows of course, that all antiseptics or ingredients of any kind that resist decomposition are the best remedies, and under this head, we recommended the chloride of lime as a very efficient disinfecting agent. We will take occasion to add a few more remarks here, which may be of considerable practical benefit. The said bleaching powder, as it is sometimes called, has been often recommended by medical men as a corrector or preventive of putrefaction—but it is somewhat strange that it is hardly ever used by poor people, who are in most need of its benefit. We think that this arises in part from an ignorance of its nature, and manner of using it, and also the high price that they are charged for it, at retail druggist stores. We will endeavour, therefore, to give them a little information on this subject. Good chloride of lime, of an acrid, pungent taste and strong odour, (and if it has not these qualities it is no better than common lime,) may be obtained of the wholesale stores at six cents per pound, while at the retail ones, they charge from one to two shillings. When wanted to purify the air of an apartment situated in a low cellar, where a free circulation of air cannot be obtained, or in chambers where sick people are confined, the best plan is to put one pound in a wooden vessel, with four or five quarts of water, stir it well occasionally, until you think the water has received all the chlorine by the lime being reduced to powder. In this state, with the vessel left open in a corner of the apartment, it will give out an odour during the whole day, (by being stirred occasionally,) sufficient to purify the air, and to neutralise the bad effects proceeding from the exhalations of all putrescent substances, and affords a grateful smell, both to healthy and sick people, although disagreable at first to some. If a strong odour is wanted, a little sulphuric acid may be added—but then its effects will be sooner dissipated. There are a good many other purposes to which this substance may be applied with great benefit. The clear part of it, which is the liquid, carefully poured off, without any of the sediment, is an excellent wash for the mouth, cleansing the teeth, preventing and alleviating the toothach. It is also a good liquid for washing a recent wound, that has been inflicted by any foul instrument or substance, and in fact, any diluted acid or alkaline is very good for that purpose. I confidently believe, that, on the occasion of bites from serpents or mad dogs, if the part injured were immediately washed with a strong alkalie, acid or the liquor of chloride of lime, it would have the effect of dissipating and destroying the poison, while, at the same time, it would not give so much pain as cauterising and cutting out the part—the usual method resorted to.*

* The sting of a viper is said to be of an acid quality, and ammonia is the best remedy.

It would be too tedious to enlarge on all the useful purposes to which the chloride of lime can be applied, we shall therefore only mention one more. We should think it might be a means of purifying tainted air in the torrid climes, particularly in individual dwelling houses, and on board ships. A little of it might be kept in water, and occasionally stirred so as to scent the air where a number of individuals are at work, and if this could not be accomplished conveniently, it might be left in their sleeping apartments. It is believed that during sleep, people are much more apt to receive injury than when awake, as the system, when active, is more apt to reject pernicious influence than when in a state of inactivity. In the unhealthy parts of Africa, a little of it might be used aboard ships with great advantage, in preventing the fatal effects of marsh miasmata. In Lauder's Voyage to Africa, if this material had been used aboard the ships, we presume a great many lives might have been saved.

We have seen most distressing accounts of the fatal effects produced by the emanation of noxious gases, proceeding from the burying places in London—we are surprised that no mention is made of the chloride of lime being used on these occasions, which would certainly be of great benefit. An idea has often occurred to us, which we insert here, as it may be of some benefit in those large cities, where burying places are with great difficulty, procured—this is deviating entirely from our subject, but as it is short, and of some importance, we hope our readers will excuse its insertion. In large cites, adjoining the sea, or large rivers, where it is difficult to find places of interment, we should think it would be a good plan to deposit the dead in the sea. This plan would be much cheapar than the present mode, as the expense of a grave and grave digging might be saved. The hire of a vessel to carry out the funeral attendants to the most convenient distance, would be the only large item of expense attending it. We are convinced that this plan requires only an example or two to make it become general ; it is not in reality, when properly considered, any more revolting to the feelings, to immerse in the sea, than to bury in the earth, the one method is as unclean as the other. Every demonstration of respect might be shown the deceased, in the former case as well as the latter, and all the solemnities by which mankind are desirous of hallowing the remains of their friends, might be shown in every respect. It is true, a memorial could not be raised to mark the spot, but this the poor (to whom we principally alluded) cannot do on the earth, as several persons at short intervals of time, are frequently deposited in the same grave. A great many persons have a great dread that their deceased friends might be disinterred for the purpose of dissection—in the mode alluded to, no such fears need be entertained, as they could not well be recovered from the bottom of the sea. The thought of destruction, by fishes, might be harrowing to the feelings, but it is not more revolting than the same process performed in the earth by filthy and disgusting reptiles.

CONCLUSION.

If this theory should be found correct in its principal details, as we trust and feel confident that it will, it may not be the least of the benefits to be derived from it, that it affords the most striking display of Divine Wisdom and Power, that has ever been exhibited in the operations of Nature. The workmanship of a mechanic is admired, according as he makes one motion execute a great variety of movements; but here, the great Architect of the universe, with astonishing simplicity and power, has formed the electric fluid, and directed it to perform a great variety of striking, beautiful, awful, and sublime operations; at one time evincing its great utility, at another, striking terror and dismay. Now it is passing over the earth, imparting a cooling influence to it where it is warm, and supplying the material of fire where it is cold; then again it is rending the ground under our feet, making the earth reel to and fro, like a drunken man. A vast volume of it is placed in the Heavens, dispensing light and heat, and causing the earth to bud and blossom like a rose. It is evolved in the atmosphere above our heads; a grand and fearful war of the elements ensue, as it did under our feet, flash and report succeed each other, until the commotion subsides in fructifying showers. Again it is wafting the pestilence over the face of the earth, and diffusing throughout the land diseases and death, causing the utmost dread and consternation, and decimating, in its progress, the human race. Now it is bringing grateful sounds to our ears, and affording beautiful displays of nature to our visual organs. It is the source of life, and the cause of vitality, in all created beings, from the lofty eminence of mankind, down to the lowest insect—from the monarch of the forest, down to the most minute vegetable existence; it is the medium of intelligence, perception and sensation, by which impressions are conveyed to and from that wonderful structure of the component part of animals, the brain. What a perpetual motion is this, without loss or waste, or one atom of matter annihilated! How insignificant in comparison is the most perfect workmanship of man! Well might Addison exclaim—

"When all thy mercies, O! my God,
My ravished soul surveys,
Transported with the view, I'm lost
In wonder, love and paise."